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Contents:

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Internal Symbiosis in Insects	*A. G. Richards and M. A. Brooks*
Nutritional Requirements of Phytophagous Insects	*W. G. Friend*
Recent Advances in Silkworm Nutrition	*J. M. Legay*
Uses of Sounds by Insects	*H. Frings and M. Frings*
Dynamics of Insect Populations	*A. J. Nicholson*
Ovarian Structure and Vitellogenesis in Insects	*P. F. Bonhag*
Genetics and Breeding of the Honey Bee	*W. C. Rothenbuhler*
The Phylogeny of the Panorpoid Orders	*H. E. Hinton*
Zoogeography of Insects	*J. L. Gressitt*
Hybridization and Speciation in Mosquitoes	*L. E. Rozeboom*
The Feeding Habits of Biting Flies and Their Significance in Classification	*J. A. Downes*
Resistance of Plants to Insects	*R. H. Painter*
Biological Control of Insect Pests	*C. P. Clausen*
Biology of Scarabaeidae	*P. O. Ritcher*
Insect Eradication Programs	*W. L. Popham and D. G. Hall*
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Organic Phosphorus Insecticides for Control of Field Crop Insects	*W. A. L. David*
Insecticides for Control of Adult Diptera	*R. W. Fay and J. W. Kilpatrick*
Forage Insects and Their Control	*G. G. Gyrisco*
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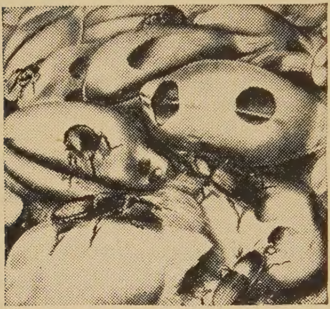
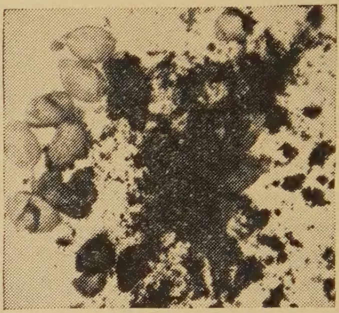


Grain weevils eating stored grain (much magnified).



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SORGHUM	Kernel smut · Leaf spot
GROUND-NUTS	Black rot · Foot rot
JUTE	Stem rot
SUGAR BEET	Black leg

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MORRISON (H.) & RENK (A. V.). **A selected Bibliography of the Coccoidea.** —*Misc. Publ. U.S. Dep. Agric.* no. 734, [1+] 222 pp. Washington, D.C., 1957.

This bibliography includes the titles of some 3,000 papers published up to the end of 1955, with brief indications of their contents. It is restricted primarily to the field of classification, and the more utilitarian aspects, including economic importance or control, are excluded.

ALFARO MORENO (A.). **Farmacopea agrícola. Formulario contra plagas y enfermedades de las plantas.** [Agricultural Pharmacopoeia. Formulary for the Treatment of Pests and Diseases of Plants.]—*Manuales tec.* (G) no. 20, xvi + 289 pp., 50 figs., 1 fldg. chart, 26 refs. Madrid, Minist. Agric., 1958. Price 60 *ptas*.

This handbook on the chemicals used in plant protection was written for agriculturists in Spain and is divided into five parts. The first is introductory in character and contains general information on the life-cycles and habits of insect and other animal pests of plants, with notes on fungi, other agents of disease, including viruses, and weeds, and their control. The second is devoted to insecticides, which are grouped according to their chemical constitution or mode of action, and includes a section on attractants, repellents and adhesives and another on antidotes for use in cases of poisoning. The information on individual chemicals comprises a summary of their properties, the insects against which they are effective, the ways in which they are used, with formulae for their application, and their compatibility with other materials. Fungicides and herbicides are dealt with in the two following parts, and the last contains a list of insect and other pests arranged under the plants attacked, with references to the formulations recommended for their control, a list of chemicals showing the proprietary forms in which they are available in Spain, a selected bibliography and a general index.

AUBIN (—). **La mouche des fruits dans la région parisienne en 1955.**—*C.R. Acad. Agric. Fr.* **42** no. 11 pp. 553–556. Paris, 1956.

Ceratitis capitata (Wied.) caused serious infestation of fruits, notably apricots, peaches and pears, in the environs of Paris in 1955, when the summer was unusually warm and dry, and attempts at control by means of sprays and bait-traps had little effect. It is not known whether the Trypetid overwinters in the area [*cf. R.A.E.*, A **42** 184], but as the preceding winter was mild, it may have done so on that occasion. Imported fruits comprise the main source of infestation, however. When these are found to be infested, they are commonly discarded and eventually reach, with other vegetable refuse, one of the four garbage disposal plants round Paris. In two of these, the garbage is burnt, but in the other two it is passed through screens, the product subsequently being used as fertiliser. Incineration of all city garbage would prevent the emergence of large numbers of fruit-flies, and it is recommended that this should be done, at least in July–September.

SAVARY (A.) & BAGGIOLINI (M.). **La pyrale de la vigne:** *Sparganothis pilleriana* **Schiff. (Lep. tortricide), ravageur nouveau des fraisières valaisannes.**—*Rev. rom. Agric.* **12** no. 12 pp. 120–123, 6 figs., 5 refs. Lausanne, 1956.

Sparganothis pilleriana (Schiff.) was found in May and June 1956 infesting strawberry in several localities in the Swiss canton of Valais. Descriptions are given of all stages of this Tortricid, together with notes on its bionomics. The eggs were laid in masses of 25–100 on the upper surfaces of the lower leaves, and the newly hatched larvae overwintered among débris. Activity was resumed in April and continued until June, the larvae feeding on the leaves and fruits and webbing them together. Pupation occurred in folds in the leaves, and the adults were present from July until the end of August. Eggs were laid a few days after emergence, the number per female ranging up to 200. As the larvae are difficult to reach by the time the damage is observed, eggs were treated with contact poisons in a test in August 1956, but sprays containing nicotine or diazinon were ineffective and parathion at 0·02 per cent. gave only 55 per cent. control. Better results might be obtained by spraying as soon as the larvae hatch or when they leave their hibernation quarters.

Husson (R.). **Sur la biologie du coléoptère xylophage** *Platypus cylindrus* **Fabr.**—*Ann. Univ. sarav.* (*Sci.*) **4** no. 4 pp. 348–356, 1 fig., 23 refs. Saarbrücken, 1955. (With a Summary in German.)

Platypus cylindrus (F.), which infests various deciduous trees, damages freshly felled oak logs in the Saarland and also occasionally injures standing trees. The galleries extend to the heartwood and become covered with the fungus mycelium on which the larvae feed. The life-cycle of this Platypodid is described, and it is recommended that felled logs should be freed from bark, weathered as rapidly as possible and treated with insecticides in May, before the adults emerge.

Husson (R.). **Les ennemis naturels de l'***Ennomos quercinaria* **Hfn. lors de sa récente pullulation en Sarre.**—*Ann. Univ. sarav.* (*Sci.*) **5** no. 1 pp. 40–44, 19 refs. Saarbrücken, 1956.

During the recent outbreak of *Ennomos quercinaria* (Hfn.) on beech and hornbeam near Saarbrücken, which lasted from 1952 to 1954 [*cf. R.A.E.*, A **43** 366], observations were made on the natural enemies of this Geometrid. Hymenoptera were numerous; *Telenomus* (*Aholcus*) *dalmanni* (Ratz.) parasitised the eggs, *Campoplex* (*Eulimneria*) sp. and *Macrocentrus abdominalis* (F.) the larvae and *Pimpla instigator* (F.), *Apechthis* (*P.*) *rufata* (Gmel.) and *Lissonota buolianae* Htg. the pupae. Tachinids were more important, however, although they did not seem well adapted to this host. *Pales* (*Ctenophorocera*) *pavida* (Mg.) was the most frequent, followed by *Blondelia nigripes* (Fall.), *Zenillia* (*Phryxe*) *nemea* (Mg.) and *Z.* (*P.*) *longicauda* (Wainwright). Considerable mortality of the larvae was caused in 1954 by a virus disease [*cf.* **44** 310]. *Ennomos* was rare in 1955 and was not observed at all in 1956.

Speyer (W.) & Waede (M.). **Feinde und Parasiten der Weizengallmücken. (Beitrag zur Biologie und Bekämpfung von** *Contarinia tritici* **Kirby und** *Sitodiplosis mosellana* **Géhin.)** [Predators and Parasites of the Wheat Gall-midges. Contribution to the Biology and Control of *C. tritici* and *S. mosellana*.]—*Anz. Schädlingsk.* **29** pt. 12 pp. 185–191, 2 graphs, 10 refs. Berlin, 1956.

Periods in which infestation of wheat by *Contarinia tritici* (Kby.) and *Sitodiplosis mosellana* (Géh.) is severe alternate with others in which it is practically absent. Weather is partly responsible, but natural enemies also play an important part. The authors review the literature on the latter [*cf.* *R.A.E.*, A **26** 231; **27** 268] and give the results of investigations carried out in northern Germany in 1954–56. Soil samples taken in the autumn of 1954 gave rise in June–July 1955 to 1,589 adults of *C. tritici*, 889 of *S. mosellana* and 198 Hymenopterous parasites, and Hymenoptera swept from wheat in Lower Saxony and Holstein in the summer of 1955 were identified as *Leptacis tipulae* (Kby.), *Isostasius inserens* (Kby.), *Platygaster tuberosa* Nees and *Macroglenes penetrans* (Kby.), which parasitise the Cecidomyiids and of which the last three were the most numerous. Further soil samples were taken in the winter of 1955–56 and yielded 2,225 adults of *C. tritici* and 675 of *S. mosellana*, together with 20 of *L. tipulae*, 76 of *I. inserens*, 125 of *P. tuberosa* and 57 of *M. penetrans*.

Development of the parasites in the host larvae takes place in spring, and parasitised individuals can then be distinguished by their appearance. In soil samples taken in the spring of 1955 in various districts of Lower Saxony, larvae showing parasitism were first observed on 10th–20th May and were most numerous on 15th June, when they comprised 36·3–96·4 and 16·6–45·7 per cent. of the populations of the 1954 generation of *S. mosellana* and *C. tritici*, respectively, and 22·2–30·9 and 3·2–30·5 per cent., respectively, of those of the 1953 generation that overwintered twice [*cf.* **32** 225]. The percentages were higher on 24th June, owing to emergence of adult Cecidomyiids from the samples before that of the parasites, and the net catches also indicated that the parasites emerged later than the gall-midges. The total parasitism of the larvae of the 1953 and 1954 generations was 10–30 and 40–60 per cent., respectively.

During the investigations, large numbers of an Empid were found among adults of both *C. tritici* and *S. mosellana* in net catches, and they probably feed on the midges. A predacious mite, possibly *Anystis vitis* (Schr.), was abundant in the catches in Lower Saxony in 1954, and may also have afforded some control. Many larvae were attacked by polyhedral disease, but this was less important as a control factor than the parasites. The control given by these and by predators, however, is insufficient to have much effect on changes in population of the Cecidomyiids, which must therefore be determined by weather.

Heie (O.). **To nye bladlusarter for Danmark,** *Myzus ascalonicus* **Doncaster og** *M. caryophyllacearum* **H. R. L. (Homoptera: Aphididae).** [Two Aphids new to Denmark, *M. ascalonicus* and *M. certus*].—*Flora og Fauna* **63** pp. 85–89, 13 refs. Silkeborg, 1957. (With a Summary in English.)

The two Aphids recorded from Denmark are *Myzus ascalonicus* Doncaster, which was found in glasshouses on chives in 1951, chickweed (*Stellaria media*) in 1952 and on tulip and *Campanula* in 1957, and *M. certus* (Wlk.) (*caryophyllacearum* H. R. L.), which was found on *Cerastium* sp. in 1950. The world distribution of *M. ascalonicus* is reviewed [*cf.* *R.A.E.*, A **45** 128, etc.].

Sborník cukrovarnicko-řepařské Konference v Praze 14.–19.x.1955. [Proceedings of the Conference on Sugar and Beet in Prague 14th–19th October 1955.]—8¼ × 6 ins., 2 vols., 49 pls., text illus. Prague, Minist. potravinářsk. Průmysl., 1957.

The first of these two volumes of the proceedings of a conference held in Prague in 1955 contains a section (pp. 467–577) consisting of papers relating to pests and diseases of sugar-beet. Those on insect pests are noticed below.

Buzanov (I. F.). **The Principles of the Control of Pests and Diseases of Sugar-beet in the Soviet Union** (pp. 467–482) [in Russian, with summaries in Czech and German]. The author reviews the principal pests and diseases of beet in the Soviet Union and the way in which control of them is organised. The main pests are *Cleonus* (*Bothynoderes*) *punctiventris* Germ. in the Ukraine, flea-beetles (chiefly *Chaetocnema concinna* (Marsham), *C. breviuscula* (Fald.) and *Psylliodes cupreata* (Duft.)) in the central black-soil belt, the Krasnodar and Altai regions, and the republics of Central Asia, *Poeciloscytus cognatus* Fieb. in Altai and Krasnodar, *Gnorimoschema ocellatella* (Boyd), an outbreak of which was in progress in Krasnodar and the south of the Ukraine, and *Melolontha melolontha* (L.), *Amphimallon solstitiale* (L.) and Elaterids in the western Ukraine. Others are more local in occurrence.

Racoviţa (A.). **Protecţia sfeclei de zahăr in R. P. Romînă** [The Protection of Sugar-beet in Rumania] (pp. 483–501) [with summaries in Czech, Russian and German]. The chief pests of beet in Rumania are *C. punctiventris*, *Tanymecus palliatus* (F.), *T. dilaticollis* Gylh., *Chaetocnema* sp., *G.* (*Phthorimaea*) *ocellatella* and *Agrotis segetum* (Schiff.). The organisation of measures against these and diseases of beet is reviewed.

Chrzanowski (J.). **Występowanie nowego szkodnika buraków w Polsce** (*Empoasca pteridis* **Dhlb.**) [The Occurrence of a new Beet Pest (*E. pteridis*) in Poland] (pp. 515–520, 1 pl., 12 refs.) [with summaries in Czech, Russian and German]. *Empoasca pteridis* (Dahlb.), which had not previously been recorded as a pest in Poland, was observed on beet there in 1955. Both seed and root crops were infested, and feeding resulted in a crinkling of the leaves. This Cicadellid also occurs on beet in Sweden, and has been reported there to transmit the virus causing beet mosaic.

Karpova (A. I.). **Data on the Ecology and Noxiousness of the Swedish Fly.** [*In Russian.*]—*Zool. Zh.* **35** pt. 5 pp. 729–740, 5 graphs, 13 refs. Moscow, 1956. (With a Summary in English, suppl. pp. 10–11.)

Oscinella pusilla (Mg.) is usually considered a variety of *O. frit* (L.) [*cf.* *R.A.E.*, A **27** 270, etc.; **28** 61], but Selivanova, working in the Voronezh region, concluded in 1951 that it was a distinct species. The typical forms differ in that the tibiae are dark in *O. frit* and mainly yellow in *pusilla*, but numerous individuals showed intermediate coloration. *O. frit* and the transition forms were found mainly infesting oats, whereas *pusilla* preferred barley. Selivanova also considered some of the transition forms to represent distinct species.

From observations in 1952–54 and examination of material from various parts of the Soviet Union, the author found that *O. frit* and *pusilla* were not uniform in geographical distribution, but that *pusilla* predominated in the steppe region of the European and Asiatic parts of the Union and in the forest-steppe zone, being apparently favoured by the dry climate and high summer temperatures, whereas *O. frit* and the transition forms predominated in the Leningrad region, White Russia, the Ukraine and the mountain districts of the Caucasus, where the climate was moister and more temperate, though some individuals of each occurred in the main region of the other. They also occurred on the same crops, but *pusilla* predominated on barley, winter rye, *Agropyrum repens* and *A. cristatum*, and *O. frit* and the transition forms on oats and related plants, including *Phleum pratense* and *Lolium perenne*. Wheat was infested to some extent by all forms. A table is given showing the occurrence of the various forms on cereals in the Stalingrad region, where the climate is of the continental type, and a district in Georgia, where conditions are milder and damper, especially in summer and autumn. All were present in both regions, but *O. frit* and the transition forms greatly predominated in Georgia. They were further all reared from the same plants in the two regions, and breeding experiments were therefore carried out to determine the constancy of the various colour forms. When 12 pairs of *O. frit* from Stalingrad were caged on oat plants in spring and the resulting puparia dissected from the plants and transferred to tubes, adults typical of *O. frit* and transition forms both emerged, the latter being the more numerous. Only transition forms were used for further rearing, and it was found that the offspring of the second and third generations, which emerged in July and August, were almost entirely and entirely transition forms, respectively. Adults characteristic of *O. frit* appeared in increasing numbers in the autumn generations, in September and October, and it is concluded that the transition forms are seasonal variations of *O. frit*. They interbred freely with typical *O. frit* in the laboratory, giving rise to fertile offspring, whereas males of *pusilla* could be induced only rarely to mate with females of *O. frit* or the transition forms, the offspring of such crosses belonging either to the transition forms or to *pusilla*.

In another experiment, adults of *pusilla* from *Agropyrum repens* in Stalingrad were caged with various graminaceous plants, and the resulting puparia transferred to tubes, and *O. frit* was simultaneously reared in another cage on the same plants. Almost all the offspring of the F_1 generation of *pusilla* showed characteristics peculiar to *pusilla*. Most of these were obtained from barley and spring wheat and only a few from oats. Almost all the offspring of the corresponding generation of *O. frit* were of the parental and summer forms; most of them were obtained from oats, and only a few from barley or *A. repens*. Some adults showing characteristics of the summer forms of *O. frit* were nevertheless found among the offspring of *pusilla* that had developed on spring wheat or barley, and single adults of *pusilla* appeared among the offspring of *O. frit* that had developed on spring wheat or oats. When four further generations were reared, however, the various colour forms persisted without change.

Similar rearing tests in Georgia gave different results. Adults of the overwintered generations of *pusilla* did not oviposit on oats at all when other plants were available, and, among the offspring of individuals that reproduced on barley or other preferred food-plants, many showed characteristics of *O. frit*. Those showing characteristics of *pusilla* gave rise to adults of both forms on winter wheat or barley or spring wheat, but only to adults of the type of *O. frit* on oats. On the other hand, the offspring of *O. frit* reared on the different plants were all similar to their parents, or of the summer form, except on one occasion when two individuals of the *pusilla* type were obtained from spring wheat. All the plants offered were infested, but barley, *A. repens* and winter rye much less than the others.

It is concluded that *pusilla* is a biological form of *O. frit* infesting barley and related graminaceous plants.

Colyer (C. N.). **Phorid Flies damaging cultivated Mushrooms;** *Megaselia* (*Megaselia*) *plurispinosa* **(Lundbeck, 1920) (Diptera, Phoridae) a Synonym of** *Megaselia* (*M.*) *halterata* **(Wood, 1910).**—*J. Soc. Brit. Ent.* **5** pt. 5 pp. 166–171, 8 figs., 13 refs. Manchester, 1956.

Two species of Phorids were found infesting cultivated mushrooms in England in 1953. One, *Megaselia bovista* (Gimmerthal), was not numerous and occurred only in Shropshire, but the other was common and present at several widely separated places. It was provisionally identified as *M.*

plurispinosa (Lundbeck), but it is concluded from a comparison of descriptions and specimens that, as had already been suspected, this is a synonym of *M. halterata* (Wood).

Behura (B. K.). **The Biology of the European Earwig,** ***Forficula auricularia*** **Linn.**—*Ann. Zool.* **1** no. 5 pp. 117–142, 2 figs., 57 refs. Agra, 1956.

The following is based on the author's summary. Nymphs and adults of *Forficula auricularia* L. were reared in tubes containing a layer of moist cotton-wool, a layer of sterilised soil and an upper layer of moist filter paper, with a cork stopper having a glass capillary to allow aeration. The earwigs thrived on a diet of dandelion flowers and dead insects, and it was established for the first time from the results obtained and those of field observations near Edinburgh that the females produce two broods a year and occasionally three in Britain, so that there is no fundamental difference in the seasonal history between that country and the United States [*cf. R.A.E.*, A **30** 275]. The males usually succumb to winter conditions, but occasionally survive until March if the eggs, which are usually laid between late November and March, are not deposited until later. In such cases, the male is not ejected from the nest until the female produces its first brood. No differences were observed between unfertilised and fertilised females with respect to the number of eggs laid, or parental care. Pairing took place in winter, and the number of eggs per female varied from 17 to 61, with an average of 40 in the first brood and from 6 to 36, with an average of 21, in the second; one laid 23 third-brood eggs. At laboratory temperature, the eggs of the first, second and third brood hatched in 24–28, 19–28 and 19 days, respectively. The nymphs passed through five instars, and those that hatched from the first-brood eggs in the last week of March 1948 reached maturity in an average of 86 days. The growth-rate was directly proportional to variation in temperature.

Laughlin (R.). **Storage and Utilization of Reserves by the Garden Chafer,** ***Phyllopertha horticola*** **L.**—*J. exp. Biol.* **33** no. 3 pp. 566–575, 2 graphs, 11 refs. London, 1956.

The following is substantially the author's summary. Samples of all stages of *Anomala* (*Phyllopertha*) *horticola* (L.) collected in north-western England were analysed for their contents of fat, nitrogen and glycogen. Total nitrogen content increased throughout the larval feeding period, whereas fat and glycogen were laid down mainly in the latter half [*cf. R.A.E.*, A **45** 219]. From November, when the third-instar larvae enter hibernation, until June, when the females have matured and laid their eggs, no food is taken. Of the store of fat and glycogen in the hibernating larva at the beginning of winter, half was used up by the time the adult emerged, and, in females, the other half was used in the formation of eggs [*cf.* **44** 184]. Adult feeding provided energy for post-oviposition activity.

Mead-Briggs (A. R.). **The Effect of Temperature upon the Permeability to Water of Arthropod Cuticles.**—*J. exp. Biol.* **33** no. 4 pp. 737–749, 4 figs., 17 refs. London, 1956.

The following is virtually the author's summary. The effect of temperature alone upon the permeability of arthropod cuticles was investigated by measuring the rate of transpiration into a constant saturation deficit at a number of temperatures. The permeability of the cuticles of a woodlouse

(*Oniscus asellus* L.) and a centipede (*Lithobius* sp.) was little affected by temperature. The cuticles of adults of *Calliphora vicina* R.-D. (*erythrocephala* (Mg.)), *Glossina palpalis* (R.-D.), *Blatta orientalis* L. and *Periplaneta americana* (L.) became progessively more permeable as the temperature was raised from 30 to 50 or 55°C. [86 to 122 or 131°F.]. That of larvae of *Tenebrio molitor* L. behaved similarly, but the increase in permeability was less marked until the temperature rose above 40°C. [104°F.]. The progressive increase in permeability of the cuticle of *Periplaneta* was entirely eliminated if the soft wax coating was removed. The increase in permeability of the insect cuticle with temperature is approximately exponential and cannot result from a single, abrupt change in a wax layer at a critical temperature [*cf.* *R.A.E.*, A **34** 60, 61]. Possible physical bases for a continuous change are discussed.

CLARKE (K. U.). **The Relationship of Oxygen Consumption to Age and Weight during the post-embryonic Growth of** *Locusta migratoria* **L.**—*J. exp. Biol.* **34** no. 1 pp. 29–41, 9 graphs, 12 refs. London, 1957.

The following is based almost entirely on the author's summary. The weight and oxygen consumption of females of *Locusta migratoria migratorioides* (R. & F.), six of each instar, were measured at 12-hourly intervals through each of the first five instars and at intervals of 24 hours during adult life. An analysis of short-duration changes showed that fluctuations in live weight are unavoidable in the growing animal, and that they are accompanied by fluctuations in oxygen consumption, which lag behind them in time. As the fluctuations of these two variables are out of phase, there is a considerable range in the oxygen consumption that must be regarded as normal for any given weight. The limits of these fluctuations compatible with normal growth are calculated. The changes that occur during a stage can be represented by a straight trend line for both weight and oxygen consumption, except in the case of weight of the adult, for which two straight lines, one for the growing period and one for the period of steady weight are necessary. In the fifth instar, two straight lines are sometimes necessary to express the trend in oxygen consumption, which may show an abrupt change in the middle of the instar. A high degree of correlation was found between the trend lines for weight and oxygen consumption in the early instars, and a low degree in the later instars, in which the weight increases and the oxygen consumption remains nearly constant.

ALBRECHT (F. O.) & VERDIER (M.). **Le poids et le nombre d'ovarioles chez les larves nouveau-nées de** *Locusta migratoria migratorioides* **R. et F.**—*C.R. Acad. Sci.* **243** pp. 203–205, 2 figs., 6 refs. Paris, 1956.

The number of ovarioles in females of *Locusta* was observed to vary between 58 and 112, and this variation has been shown by Rubtzov [*R.A.E.*, A **22** 675] to be affected by the environment and food of the hoppers. The relation of these factors to the number of eggs per pod, which differs widely in females of different phases [*cf.* **39** 138], was investigated in laboratory-reared females of *L. migratoria migratorioides* (R. & F.) in phase *gregaria*. It was found that the average number of rudimentary ovarioles in newly hatched female hoppers derived from the same egg pod varied inversely with the average weight of the hoppers, and a reduction of 1·78 in the former was associated with an increase of 1 mg. in the latter. The number of ovarioles, which varied from 73 to 110, determines the upper limit to the number of eggs per pod, and the lower limit was found to be linked with the non-functioning of some of the ovarioles, especially towards the end of adult life [*cf.* also **38** 193]. The weight of the newly hatched hoppers is influenced by the phase of their parents [*cf.* **45** 411], and this also seems to determine the number of eggs in the pods deposited by the females.

Paradis (R. O.). **La lutte contre le charançon de la prune,** *Conotrachelus nenuphar* **(Hbst.), parasite du pommier dans le sud-ouest du Québec.** —*37th Rep. Quebec Soc. Prot. Pl. 1955* pp. 88–100, 24 refs. Quebec, 1956. (With a Summary in English.)

Conotrachelus nenuphar (Hbst.) is a serious pest of apple in south-western Quebec. The literature on its occurrence and control there is reviewed, and it is shown that infestation was heavy in at least 25 of the years between 1884 and 1954. It was considerable in 1948–53, and tests on its control by means of organic insecticides were carried out on susceptible varieties in three localities in 1950–54. Each material was combined with a fungicide, and all spray quantities are given per 100 gals. In 1950, when wettable powders were tested in conventional dilute sprays, the percentages of undamaged fruits were 96·4 for 5 oz. 25 per cent. dieldrin in the pre-pink-bud and pink-bud sprays, 96·6 for 20 oz. of the same in the pink-bud, calyx and first cover sprays, 93 for 40 oz. 25 per cent. aldrin, 94·8 for 1·5 lb. 15 per cent. parathion, 90·4 for 2·5 lb. 50 per cent. methoxy-DDT (methoxychlor) with 2·5 lb. lead arsenate, and 78·6 for 2·5 lb. 50 per cent. DDT with 2·5 lb. lead arsenate, all in the calyx and first two cover sprays, and 82·5 for 2·5 lb. 40 per cent. chlordane in the two cover sprays only, as compared with 59·6 for the fungicide alone. Mist sprays were tested in 1951–53, a calyx and two cover sprays being applied, and wettable powders were used in the first two years. In 1951, the percentages of undamaged fruits were 97·1–97·9 for 10 lb. 25 per cent. aldrin, 5 lb. 25 per cent. dieldrin, 12 lb. 50 per cent. Compound 1189 [2,3,3a,4,5,6,7,7a,8,8-decachloro-3a,4,7,7a-tetrahydro-4,7-methanoindene-1-one] and 4–6 lb. 15 per cent. parathion, and 96·3 for 5 lb. 27 per cent. EPN [O-ethyl O-p-nitrophenyl phenylphosphonothioate], as compared with 90·4 for the fungicide only, and in 1952, they were 98·5 and 98·8 for the two sprays of dieldrin and 1189, respectively, 87·6 for 12 lb. 20 per cent. aldrin, 94·1 for 16 lb. 25 per cent. Dilan [a 1:2 mixture of 1,1-bis(p-chlorophenyl)-2-nitropropane and 1,1-bis(p-chlorophenyl)-2-nitrobutane] and 97·4 for 6 lb. 15 per cent. parathion with 4·5 lb. charcoal, as compared with 80·2 for the fungicide only. Dieldrin and 1189 were significantly better than aldrin or Dilan. In 1953, the percentages were 95·1 for the parathion and charcoal mixture, 96·2 for 2·5 lb. 50 per cent. wettable dieldrin and 97·4 for 1·5 gals. of an emulsion concentrate containing 50 per cent. Perthane [1,1-bis(p-ethylphenyl)-2,2-dichloroethane (ethyl-DDD)], as compared with 91·7 for the fungicide only. When the dieldrin spray was applied in the calyx and first cover sprays only, the percentage of undamaged fruits was 95·5. In 1954, when a calyx and two cover sprays were applied and conventional dilute mixtures were used, the percentages were 98 for 10 oz. 50 per cent. wettable dieldrin, 97–97·5 for 5 oz. of the same or 1·25 pints 20 per cent. dieldrin or 50 per cent. malathion, both in emulsion sprays, and 95·4 for 2 lb. 25 per cent. wettable malathion, as compared with 85·5 for the fungicide only; wettable malathion was significantly inferior to the other treatments.

Parathion and EPN caused some scorching, and emulsion sprays of dieldrin and malathion some discoloration of the fruits. Compound 1189 was difficult to apply owing to foaming. Wettable dieldrin was compatible with all the fungicides used, and it is concluded that treatment with it or with aldrin in the calyx and first cover sprays is the most suitable for use against *C. nenuphar* in Quebec.

PARENT (B.), PARADIS (R. O.), CINQ-MARS (L.) & CRÊTE (R.). **Influence de certains fongicides sur les principaux acariens des vergers du Québec.**—*37th Rep. Quebec Soc. Prot. Pl. 1955* pp. 101–110, 3 graphs, 6 refs. Quebec, 1956.

The literature on the effect of fungicides on Tetranychid mites and their natural enemies is reviewed [*cf. R.A.E.*, A **38** 270, etc.], and the results are given of observations in 1950–53 in apple orchards in south-western Quebec to determine the effect of four fungicides on the populations of *Metatetranychus ulmi* (Koch) and *Tetranychus telarius* L. (*bimaculatus* Harvey) and on species of *Typhlodromus* that prey on them. Three plots were sprayed with the same fungicide (colloidal sulphur, wettable sulphur, or ferbam (ferric dimethyldithiocarbamate)) in 1948–53 and another with sulphur in 1948, Phygon XL [2,3-dichloro-1,4-naphthoquinone] in 1949 and glyodin (2-heptadecyl glyoxalidine acetate) in 1950–53. The trees also received three late cover sprays of DDT followed by a parathion spray in 1950, a calyx spray of parathion in 1951, and lead arsenate in all four of the years 1950–53. The parathion calyx spray reduced the mite populations so greatly that no counts were made in 1951, and the numbers of *Typhlodromus* spp. were sufficiently large for counting only in 1952. Monthly samples taken in June–September showed that the number of eggs and active stages of *M. ulmi* per leaf averaged 23·6 and 11·5 for colloidal sulphur, 11·6 and 7·4 for wettable sulphur, 19·6 and 7·5 for ferbam, and 12 and 3·9 for glyodin. The corresponding figures for *T. telarius* were 7·55 and 2·57, 6·01 and 2·6, 25·2 and 16·82, and 39·66 and 17·54, and those for *Typhlodromus* were 0 and 0·02, 0·06 and 0·48, 0·21 and 1·31, and 0·17 and 0·76. It is concluded that the sulphur preparations are in general toxic to *Tetranychus telarius* and *Typhlodromus* spp. and that the differences in their effects on *M. ulmi* may be due to the different sizes of the sulphur particles. Populations of *Tetranychus telarius* in plots treated with glyodin remained high at first, but there was a reduction later, which indicated that it has a less harmful effect on the natural enemies than sulphur. Ferbam appeared to have no effect on mites at all.

PARENT (B.) & LEROUX (E. J.). **Note on** *Mediolata mali* **(Ewing) (Acarina: Raphignatidae) as a Predator of the European Red Mite.**—*Canad. Ent.* **88** no. 8 p. 487, 4 refs. Ottawa, 1956.

In July 1953, a mite subsequently determined as *Mediolata mali* (Ewing) was observed feeding on active forms of *Metatetranychus ulmi* (Koch) in an orchard in Quebec in which the use of insecticides and acaricides injurious to the natural fauna had for two years been reduced to a minimum. It increased in numbers considerably during 1954 and 1955, and exerted marked control of *M. ulmi*, which it had not previously been recorded as attacking in Canada.

DAVIAULT (L.). **The Red Pine Web-spinning Sawfly,** *Cephalcia marginata* **Middlekauff (Hymenoptera, Pamphiliidae).**—*Canad. Ent.* **88** no. 8 pp. 488–492, 6 figs., 2 refs. Ottawa, 1956.

Observations on the bionomics of *Cephalcia marginata* Middlekauff [*R.A.E.*, A **42** 421], which is present on red pine [*Pinus resinosa*] in several young plantations near Berthierville, Quebec, were made in cages, largely in 1940. This sawfly has only one generation a year and is not abundant enough to cause much damage. In 1940, adults emerged between 29th May and 14th June, with a peak on 6th June. Males were slightly more abundant than females, but the sexes are probably produced in about equal numbers. In the insectary at 62–65·4°F., males survived for 2–10 and females for 5–12 days. Oviposition began on the day of emergence or up to five days after it, and continued intermittently for 8–10 days. The eggs were laid in single rows of 4–15 on needles of the previous year, and each female oviposited on three or four needles. The average number of eggs laid by fertilised females was 24 and the maximum 49. Unfertilised individuals laid eggs that developed normally. In the field, females preferred red pine, but readily oviposited on white spruce [*Picea glauca*] on which they were caged; owing to the shortness of the needles of this food-plant only three eggs could be deposited on each. In 1940–43, the eggs hatched in 18–31 days. The larvae fed gregariously on the needles at the intersection of two small branches within a web in which débris accumulated; the webs normally contained 12–15 larvae each, though some were found to contain 20. In 1940, when peak hatching occurred on 18th June, most of the larvae had left the webs by 14th August, indicating a larval period of about 57 days. The larvae overwintered in the soil, and most of them pupated in the following spring; of 406 that entered hibernation in 1939, 29 remained in diapause until 1941 and five until 1942. Two Tachinids, five Ichneumonids and the Pteromalid, *Psychophagus omnivorus* (Wlk.), were reared from *C. marginata* in 1940.

Smith (O. J.), Hughes (K. M.), Dunn (P. H.) & Hall (I. M.). **A Granulosis Virus Disease of the Western Grape Leaf Skeletonizer and its Transmission.**—*Canad. Ent.* **88** no. 8 pp. 507–515, 1 fig., 5 refs. Ottawa, 1956.

Attempts since 1950 to rear insect parasites in large numbers in the laboratory on *Harrisina brillians* B. & McD. for release against the latter on vines in California [*cf. R.A.E.*, A **42** 16] were unsuccessful owing to recurrent outbreaks of a granulosis virus disease of the host larvae [**41** 89], the symptoms of which are described. Relatively healthy populations of *H. brillians* could be obtained only from vines that had been dusted with cryolite, whereas the disease apparently occurred throughout the untreated areas and was epizootic where *H. brillians* was numerous. Since insect parasites, of which the principal species were *Sturmia harrisinae* Coq. and *Apanteles harrisinae* Mues., were absent from the dusted areas and gradually increased in the untreated ones, since heavy infestation of wild vines by *H. brillians* frequently died out at an early stage and since mortality in laboratory stocks was often heavy immediately after hatching, the part played by the parasites in transmitting the disease and the possibility of transovarial transmission were investigated. The disease is characterised by failure of the eggs to hatch or of the larvae to feed, abnormal feeding (resulting in perforation instead of skeletonisation of the leaves), a reduction in size and a change in coloration in the larvae, which usually emit a brownish discharge, and death, which may not occur until the prepupal or occasionally the pupal stage. Infected newly hatched larvae die suspended from a silken thread; moths from heavily infected colonies of larvae sometimes fail to emerge from the cocoon and vary widely in size, but otherwise show no symptoms. Rapidly vibrating virus capsules within cells or spherical vesicles were seen in the mid-gut epithelium of infected larvae in all instars, in the prepupae, and in the pupae, and capsule-like objects were detected in eggs laid by contaminated females and in the ovarian eggs of such individuals, but the evidence for transovarial transmission remained indicative only.

In a preliminary test of infectivity, eggs of *H. brillians* laid by females believed to be healthy were disinfected by immersion for two hours in 20 per cent. formaldehyde (which did not harm them), and third-instar larvae from them were allowed to feed on leaves dipped in a suspension of the virus prepared by grinding 100 diseased larvae in 250 ml. water. All became moribund within 12 days, and characteristic vibrating particles were visible in the cell walls of the gut epithelium. There was no mortality among control larvae. In another experiment, third-instar larvae that were fed on infected foliage ceased feeding after 5–8 days; mortality was first observed among them after six days, and 50 and 100 per cent. were dead after 6·9 and 12 days, respectively. The corresponding figures for first-instar larvae placed, three days after hatching, on contaminated leaves and transferred to uncontaminated ones after four days (by which time they had moulted) were 9–19, 9, 16·5 and 31 days.

When larvae from healthy stocks were reared in the laboratory at low densities, they usually remained healthy, but if they were first exposed to *S. harrisinae* or *A. harrisinae*, up to 20 per cent. died from causes other than known parasitism. On dissection, many of these dead larvae were found to contain dead parasite larvae and to show indications of virus infection, and infection was also found in a few host larvae from which *A. harrisinae* had emerged. In a test, larvae of *H. brillians* were reared in small groups after being confined for 48 hours in large cages with adults of *A. harrisinae* or *S. harrisinae* that had previously walked over a virus-contaminated surface. Some gave rise to adult moths and about half to adult parasites, but significantly more larvae became moribund or died without giving rise to parasites than among control larvae not previously exposed to them; among such larvae, 25–38·5 per cent. were found to be infected with the virus, as compared with 0 among the controls. This result is regarded as no more than indicative of a correlation between parasites and infection, since an unidentified fungus was found in some of the larvae and the mechanical effects of parasitism may also have caused mortality. In the field, parasites are most likely to become infected by contact with the discharge from diseased larvae, and other arthropods moving over the leaves may therefore be involved in transmission. The virus may also be disseminated by rain and wind.

LeRoux (E. J.) & Parent (B.). **Note on the Leaf Miner** *Lithocolletis malimalifoliella* **Braun (Lepidoptera: Gracillariidae) as an Apple Pest in Quebec.**—*Canad. Ent.* **88** no. 8 p. 515, 4 refs. Ottawa, 1956.

During 1953–55, apple trees in an orchard at Farnham, Quebec, were heavily infested by *Lithocolletis malimalifoliella* Braun, as a result of which the crop was damaged. This leaf-miner is a persistent and sometimes serious pest of apple in Nova Scotia, but has not hitherto been reported from Quebec, although a survey showed it to be present in all the major apple-growing areas. It passed through two complete generations and a partial third each year and overwintered in the pupal stage. Inspection of the mines in 1954 and 1955 showed that 40 and 45 per cent., respectively, of the pupae were parasitised by a Braconid identified as *Apanteles ornigis* Weed.

Putman (W. L.). **Differences in Susceptibility of two Species of** *Chrysopa* **(Neuroptera: Chrysopidae) to DDT.**—*Canad. Ent.* **88** no. 8 p. 520, 2 refs. Ottawa, 1956.

Observations on predacious Chrysopids in peach orchards in the Niagara Peninsula of Ontario since 1949 showed that DDT has little effect on the larvae of *Chrysopa plorabunda* Fitch but causes reductions in those of *C. rufilabris* Burm., and figures are given illustrating this for 1953–55. *C. rufilabris* was more abundant than *C. plorabunda* in 1931–35 but the latter has become the more numerous since about 1950, even in unsprayed orchards, and this is attributed to a decline in numbers of *C. rufilabris* following the general use of DDT in the district.

Kenaga (E. E.). **Some biological, chemical and physical Properties of Sulfuryl Fluoride as an insecticidal Fumigant.**—*J. econ. Ent.* **50** no. 1 pp. 1–6, 1 graph, 6 refs. Menasha, Wis., 1957.

Sulphuryl fluoride, which shows promise for use as a fumigant against insect pests, is non-inflammable, colourless and odourless, boils at −55·2°C., and has a high vapour pressure and low heat of vaporisation. These properties result in rapid distribution in air and penetration of commodities or structures and in ease of application. The gas is stable in air, and caused no harmful effects on metals or various other household materials exposed to a dosage of 3 lb. per 1,000 cu. ft. for 16 hours at 80°F.

Insects were exposed to different dosages for 16 hours at 80°F., those tested being adults of *Tribolium confusum* Duv., *Calandra* (*Sitophilus*) *granaria* (L.), *Rhizopertha dominica* (F.), *Oryzaephilus surinamensis* (L.), *Lasioderma serricorne* (F.), *Cynaeus angustus* (Lec.), *Periplaneta americana* (L.), *Blattella germanica* (L.), *Sitotroga cerealella* (Ol.), *Anagasta* (*Ephestia*) *kühniella* (Zell.) and *Musca domestica* L., eggs of *Tribolium*, *Calandra*, *Rhizopertha*, *Attagenus megatoma* (F.) (*piceus* (Ol.)), *Epilachna varivestis* Muls., *Periplaneta*, *Sitotroga* and *Laphygma* (*Prodenia*) *eridania* (Cram.), larvae of *Calandra*, *Attagenus*, *Cynaeus*, *Sitotroga* and *Anagasta*, and pupae of *Calandra*, *Rhizopertha* and *M. domestica*. The results were plotted, and the calculated dosages (in oz. per 1,000 cu. ft.) for 50 and 95 per cent. mortality are given. Those giving 95 per cent. kill of adults varied from 0·65 for *Rhizopertha* to 3·45 for *Tribolium*, those for pupae from 0·86 for *Calandra* to 1·36 for *Musca*, those for larvae from 0·86 for *Calandra* to 2·6 for *Anagasta* and those for eggs from 5·44 for *Sitotroga* to 75·8 for *Attagenus*.

Comparison of the doses of sulphuryl fluoride and methyl bromide necessary to give 50 and 95 per cent. mortality of adults of *Tribolium* and larvae of *Attagenus* showed that the former was the more effective in exposures of 16 hours at temperatures of 40, 60 and 80°F. and also in exposures of 0·5–5 hours at 80°F. Sulphuryl fluoride was more toxic to *Attagenus* than to *Tribolium* at 80°F. and less so at 40°, more toxic to the former than to the latter in the 16-hour exposures but about equally effective against both in the shorter ones. At a dosage of 8 oz. per 1,000 cu. ft. and an exposure of 16 hours at 80°F., sulphuryl fluoride gave complete mortality of larvae of *Attagenus* and adults of *Tribolium* at depths of 1–9 ins. in various commodities, but methyl bromide was so strongly sorbed by most of them as to be ineffective at depths greater than 1–5 ins. In tests in which the insects were buried in sand, clay loams or peat soils, the mortalities obtained indicated that sulphuryl fluoride penetrated dry soils better than wet ones, was equally effective in organic and inorganic soils and was better than methyl bromide in nearly all tests and considerably better in the organic soils.

Exposure to 16–80 oz. sulphuryl fluoride per 1,000 cu. ft. for 16 hours at 80°F. did not affect the germination of seeds of 30 wild and uncultivated plants, but exposure to 16–48 oz. for 2 hours was injurious to apples, oranges, tomatos and celery stalks, killed tomato and maize plants and caused slight russetting of potato tubers. In a special test, wheat sorbed less sulphuryl fluoride than methyl bromide when exposed to doses of 32–96 oz. per 1,000 cu. ft. for 14 days at 48°F.

STEWART (D.). **Sulfuryl Fluoride—a new Fumigant for Control of the Drywood Termite** *Kalotermes minor* **Hagen.**—*J. econ. Ent.* **50** no. 1 pp. 7–11, 4 graphs, 1 ref. Menasha, Wis., 1957.

Although fumigation with methyl bromide gives satisfactory control of *Kalotermes minor* Hag. in buildings in the United States [*cf. R.A.E.*, A **38** 368], it causes unpleasant odours in household materials containing sulphur, and sulphuryl fluoride [*cf.* preceding abstract] was therefore tested as a substitute. In laboratory experiments in which worker nymphs were exposed to sulphuryl fluoride or methyl bromide for periods of 1–24 hours at 21°C. [69·8°F.], the doses necessary for 96–100 per cent. mortality were much the same for the two compounds, but symptoms of poisoning developed more slowly for methyl bromide; mortality due to either of them all occurred within 3–5 days of treatment. When tested at a range of temperatures, sulphuryl fluoride proved slightly more toxic than methyl bromide above 13°C. [55·4°F.] and slightly less so below it; the termites became immobile at temperatures below 6°C. [42·8°F.] in the sulphuryl-fluoride treatments, but not when exposed to methyl bromide or left untreated. Treatments with 2·2 mg. sulphuryl fluoride and 2·4 mg. methyl bromide per litre resulted in 94 and 7 per cent. mortality, respectively, of nymphs confined under 28 cm. sawdust and exposed for 24 hours at 69·8°F., after which the tubes were aerated for 18 hours, and it is concluded that the fluoride is less readily sorbed by wood.

In tests in an experimental structure with a volume of 500 cu. ft., in which sulphuryl fluoride was applied at 32 oz. per 1,000 cu. ft., the concentration fell to 24 and 4·5 oz. in three and seven days, respectively, when four small holes in the sides were closed and to 9 and less than 1 oz. in 5 and 21 hours, respectively, when they were open. Polyethylene sheeting, polyvinyl-coated nylon and neoprene-coated nylon proved satisfactory when used to enclose treated structures during fumigation. Forced circulation dispersed sulphuryl fluoride rapidly and efficiently throughout a house, and no supplementary heat was necessary, owing to the low boiling point of the liquid. The gas proved harmful to ornamental plants at concentrations that would normally be used in the treatment of buildings, and though less poisonous to mammals than methyl bromide, is sufficiently toxic to them to require careful handling. A method of determining its presence in air by means of a halide leak detector is described.

LANCHESTER (H. P.) & DEAN (F. P.). **Control of San José Scale on Fruit Trees during the Prebloom Period of Pears.**—*J. econ. Ent.* **50** no. 1 pp. 14–15, 1 fig., 5 refs. Menasha, Wis., 1957.

Parathion has given good control of the San José scale [*Quadraspidiotus perniciosus* (Comst.)] on fruit trees when applied in spring [*cf. R.A.E.*, A **40** 79], and treatment at the pre-pink stage has been recommended in Washington State. As growers wished to apply the spray earlier in the season, tests were made on pear in 1953 to determine the period during which a pre-bloom spray of parathion would afford control. Both the over-wintered Coccids and the buds were still dormant on 26th February, but activity of the insects increased slightly from 4th to 19th March and the fruit buds were greatly swollen and less than half covered on 24th March. Sprays of 1 lb. 25 per cent. wettable parathion per 100 U.S. gals. water were applied on various dates, and the percentages of the insects found alive before and (in brackets) about a month later were 72 (30), 70 (32), 80 (26) and 81 (23) for applications made on 26th February and 4th, 9th and 13th March and 81 (11), 77 (4), 76 (3) and 69 (2) for those made on 19th, 24th and 30th March and 7th April. Temperatures were highest in early March, so that the increased kills given by the later applications were evidently due to the greater activity of the insects.

In 1954, sprays of 13 oz. 57 per cent. malathion and 24 oz. 21 per cent. demeton [diethyl 2-(ethylthio)ethyl phosphorothioate] per 100 U.S. gals., both in emulsion concentrates, were compared with the parathion spray in applications made on 8th March and 2nd, 9th and 16th April. The pear buds were beginning to show growth on the first date, but did not progress further for about a month, and the trees were in full bloom on 26th April. The percentages of dead Coccids were 13–18 at the time of spraying and 23, 35–46, 22–32 and 96 between 14th May and 3rd June on unsprayed trees and those receiving malathion, demeton and parathion, respectively; the corresponding numbers of scales on the fruits on 11th August averaged 86, 48, 40 and 2.

In 1955, the parathion spray and one of 2 lb. 25 per cent. wettable diazinon [O,O-diethyl O-2-isopropyl-4-methyl-6-pyrimidinyl phosphorothioate] per 100 U.S. gals. were applied to peach trees on 13th April, three weeks before flowering, or on 3rd June, a month after it, in the late sepal-fall stage. Counts on 6th and 28th June showed 98 and 93 per cent. mortality for the parathion treatments and 77 and 98 per cent. for diazinon, and it is concluded that parathion may be used against *Q. perniciosus* on any fruit trees in the two weeks before the petal-fall stage of pear. The other materials did not give sufficient control at the concentrations tested.

Steiner (L. F.). **Field Evaluation of Oriental Fruit Fly Insecticides in Hawaii.**—*J. econ. Ent.* **50** no. 1 pp. 16–24, 13 refs. Menasha, Wis., 1957.

The following is based largely on the author's summary. Insecticides that had given promising control of *Dacus dorsalis* Hend. in the laboratory were evaluated in 180 field tests, mainly on mango, banana, guava and papaya, in Hawaii in 1950–55.

The best results were given by bait-sprays containing wettable parathion or malathion and certain enzymatic or acid protein hydrolysates [*cf. R.A.E.*, A **44** 431, etc.]. Applications of 0·2–2 lb. parathion per acre with protein hydrolysate at intervals of two weeks resulted in 93–100 per cent. reduction in infestation in 13 of 21 tests; malathion bait-sprays were only slightly less effective, and neither reduced parasitism by *Opius oophilus* Fullaway. When wettable powders were applied in normal sprays to leave toxic residues, parathion, DDT, Dilan [a 1:2 mixture of 1,1-bis(p-chlorophenyl)-2-nitropropane and 1,1-bis(p-chlorophenyl)-2-nitrobutane] and methoxy-DDT (methoxychlor) were moderately or highly effective at rates affording more than 3 lb. toxicant per acre; malathion gave good control at 5–6 lb. per acre, but dieldrin and aldrin, which were sometimes highly effective at very low dosages on isolated or large plots, often failed at much higher dosages on small plots subject to reinfestation from unsprayed areas, since they apparently attracted ovipositing females or stimulated poisoned ones to increased oviposition before killing them [*cf.* B **41** 105; **46** 50]. These two insecticides were the most harmful to parasites or parasitised larvae of any tested. Dieldrin and aldrin were promising as soil toxicants against larvae or pupae, and residues from foliage sprays that reached the ground added substantially to control by reducing adult emergence. Demeton [diethyl 2-(ethylthio)ethyl phosphorothioate] was tested only on guava; thorough applications of 2 lb. or more per acre in sprays gave excellent control, which lasted sometimes for long periods, principally because of the systemic action. Pyrolan [1-phenyl-3-methyl-5-pyrazolyl dimethylcarbamate] was the most effective of the insecticides tested in aerosols, killing 98 per cent. of flies caged 800 ft. downwind when applied at 7 g. per acre. It proved more effective than parathion for use with methyl eugenol in bait-traps for attracting and killing the males [*cf.* A **44** 169].

On the basis of these and other experiments, bait-sprays of 2–4 lb. 25 per cent. wettable parathion or malathion with 1 lb. protein hydrolysate in 3–150 U.S. gals. water at intervals of 2–3 weeks, and bait-traps impregnated with methyl eugenol and Pyrolan, distributed at the rate of 40 per sq. mile, are recommended for use in any large-scale control or eradication campaign, such as might become necessary if *D. dorsalis* were to reach the mainland of the United States. Treatment of the soil under infested plants with 5–10 lb. dieldrin, aldrin, parathion or lindane [γ BHC] per acre may give valuable supplementary control. On commercial fruit plantings in Hawaii, the malathion bait-spray is the most practical, because it can be used almost up to picking.

APPLE (J. W.). **Reduced Dosages of Insecticides for Corn Rootworm Control.**—*J. econ. Ent.* **50** no. 1 pp. 28–30, 5 refs. Menasha, Wis., 1957.

Tests were made in Wisconsin in 1954 and 1955 on the effectiveness of reduced dosages of aldrin and heptachlor in protecting maize from attack by *Diabrotica longicornis* (Say). The two insecticides were equally effective in reducing plant lodging and increasing yields when applied at about the recommended rate of 1 lb. per acre in emulsion sprays to the ploughed soil or to the stubble immediately before ploughing or at 0·5 lb. per acre in starter fertiliser [*cf. R.A.E.*, A **43** 244], and heptachlor, but not aldrin, gave as good results when the doses were halved. In limited tests, both insecticides were as effective in attapulgite granules as in broadcast sprays, and aldrin, though not heptachlor, was as effective in vermiculite as in attapulgite granules when applied in starter fertiliser. In tests with other insecticides, 1·67 lb. chlordane, 0·3 lb. γ BHC and 0·5 lb. endrin per acre were as effective as 1 lb. aldrin or heptachlor in broadcast sprays, and 1 lb. chlordane per acre as effective as 0·5 lb. aldrin or heptachlor in starter fertiliser.

PARENCIA jr. (C. R.), DAVIS (J. W.) & COWAN jr. (C. B.). **Control of early-season Cotton Insects with systemic Insecticides employed as Seed Treatments.**—*J. econ. Ent.* **50** no. 1 pp. 31–36, 2 figs., 4 refs. Menasha, Wis., 1957.

Three seed treatments with systemic insecticides for the protection of cotton against *Frankliniella* sp., *Aphis gossypii* Glov., *Psallus seriatus* (Reut.), overwintered adults of *Anthonomus grandis* Boh. and a species of *Liriomyza* referred to as *L. pusilla* (Mg.) were evaluated in field experiments carried out near Waco, Texas, in 1954 and 1955.

In 1954, when the sowing rate was less than desired, so that the insecticides were distributed at 0·56 instead of 1 lb. per acre, Am. Cyanamid 12009 [O,O-diethyl S-n-propylthiomethyl phosphorodithioate] and Am. Cyanamid 12008 [O,O-diethyl S-isopropylthiomethyl phosphorodithioate] reduced plant emergence by 39 and 13 per cent., respectively; control of the thrips was effective for 3·5 weeks after plant emergence and partial for an additional week, 12008 being slightly superior to 12009, and the Aphid was controlled for 4·5 weeks, after which the infestation disappeared from the untreated plots.

In 1955, most of the seed was sown under good germinating conditions, and treatments affording 1 lb. Am. Cyanamid 3911 [O,O-diethyl S-ethylthiomethyl phosphorodithioate] and Am. Cyanamid 12008 per acre did not reduce plant emergence, except in one plot in which seed treated with 3911 was sown a day before heavy rain. Infestations of *Liriomyza* failed to develop to any extent on the cotyledons from treated seed, though 50 per cent. of untreated ones were infested, and thrips were controlled for five weeks after plant emergence, infestations approaching those on untreated plants after six weeks. Treatment with 1 lb. 3911 gave similar control of thrips to 5–6 weekly sprays of 0·75–1·5 lb. toxaphene per acre after plant emergence. When adults of *P. scriatus* and *A. grandis* were caged on the plants at weekly intervals, it was found that plant growth caused a progressive loss in the effectiveness of treatment with 1 lb. 3911; field records indicated that it remained effective for four weeks after plant emergence, whereas the toxaphene sprays kept the numbers low for six weeks. It is therefore concluded that the last of the toxaphene sprays should be applied to plots that have received the seed treatment, for protection against these two insects.

In general, seed treatment resulted in increased plant growth in the first few weeks and in accelerated and increased blooming, and in one test, both seed treatment with 1 lb. 3911 and spraying with toxaphene resulted in increased yields.

Wene (G. P.). **Cabbage Looper Control.**—*J. econ. Ent.* **50** no. 1 pp. 39–41, 2 refs. Menasha, Wis., 1957.

Since, for economic reasons, insecticides are applied to cabbage in the Lower Rio Grande Valley of Texas for the control of *Trichoplusia ni* (Hb.) only when the larvae are seen, by which time they are usually almost full-grown and difficult to control, field tests were carried out to find compounds that would control such larvae and could be used within 30 days of harvest.

In 1954, dusts were applied at 20 lb. per acre when the cabbages had not begun to form heads, the larvae were small and present on the undersides of the outer leaves, and temperatures did not exceed 75°F.; counts of the larvae showed that 1·5 per cent. endrin, 20 per cent. toxaphene and 5 per cent. DDT with either 2 per cent. parathion or 3 per cent. malathion gave complete control in a week; 5 per cent. malathion gave 83 per cent. mortality. In 1955, they were applied when the cabbage heads were almost mature, about half the larvae were half grown or larger and temperatures did not exceed 70°F., and it was found that 25–35 lb. 20 per cent. toxaphene per acre, applied with hand dusters, gave 92 per cent. control in 5–6 days, whereas 13–50 lb. of a mixture of 0·9 per cent. piperonyl butoxide with 0·06 per cent. pyrethrins, applied with hand or tractor dusters, and 25 lb. 2·25 per cent. piperonyl butoxide with 0·15 per cent. pyrethrins, applied with a hand duster, gave only 42–79 per cent., mortality being unaffected by increasing either rate of application or concentration.

In 1956, treatments were applied when the cabbages were ready for harvest, most of the larvae were two-thirds grown or larger, and the maximum daily temperature was about 90°F. The dusts were applied at 30 lb. per acre, and 0·1 per cent. pyrethrins gave 46 per cent. control in 5–6 days and 0·06 and 0·1 per cent. pyrethrins, with 0·9 per cent. piperonyl butoxide and 0·1 per cent. N-octyl bicycloheptene dicarboximide [N-(2-ethylhexyl)-bicyclo[2.2.1]-5-heptene-2,3-dicarboximide], respectively, gave 63 per cent.

or more; such dusts can safely be used just before harvest, as they leave no poisonous residues. Bayer 17147 [O,O-dimethyl S-(4-oxo-benzotriazino-3-methyl) phosphorodithioate] at 1·5 per cent. gave only 54 per cent. control, and rotenone was ineffective alone at 1 per cent. but gave 69 per cent. control at 0·75 per cent. with 2 per cent. malathion; 7·5 per cent. malathion and 20 per cent. toxaphene gave 72 and 72–75 per cent. control, respectively, and 2 per cent. Shell OS-2046 [dimethyl 2-methoxycarbonyl-1-methylvinyl phosphate] 79 per cent.

ARNOLD (E. W.) & APPLE (J. W.). **The Compatibility of Insecticides and Fungicides used for the Treatment of Corn Seed.**—*J. econ. Ent.* **50** no. 1 pp. 43–45, 12 refs. Menasha, Wis., 1957.

Maize seed sown in Wisconsin is attacked by fungi of the genus *Pythium* and by soil insects, and the compatibility of four insecticides and three fungicides in mixtures used to treat the seeds was tested. In the laboratory, treatment with 1 oz. wettable dieldrin, heptachlor or aldrin per bushel of seed had no adverse effect on the fungicidal action of captan [N-(trichloromethylthio)-4-cyclohexene-1,2-dicarboximide], dichlone [2,3-dichloro-1,4-naphthoquinone] or thiram [bis(dimethylthiocarbamoyl) disulphide], and lindane [almost pure γ BHC] gave similar results with captan, but had an adverse effect in combination with dichlone or thiram. None of the insecticides showed consistent fungicidal effect when used alone. In a field test, the stand counts and yields were not significantly different whether the seeds had been treated with fungicide alone or with a mixture of fungicide and insecticide; dieldrin showed a low fungicidal effect when used alone. The effect of the fungicides on the insecticidal efficiency of dieldrin was tested by confining adults of a laboratory strain of *Drosophila melanogaster* Mg. with treated pumpkin purée. Captan, dichlone and thiram were not toxic to the flies at concentrations of four parts per million and had no adverse effects on the toxicity of dieldrin.

ALLEN (H. W.). **Susceptibility of *Macrocentrus ancylivorus* and other Parasites of the Oriental Fruit Moth to Insecticides.**—*J. econ. Ent.* **50** no. 1 pp. 49–51, 5 refs. Menasha, Wis., 1957.

The following is based on the author's summary. Experiments were made in New Jersey in 1944 and in 1953–54 to determine whether the parasites that attack *Cydia* (*Grapholitha*) *molesta* (Busck) on peach are more susceptible than their host to deposits of DDT or parathion.

When a spray of 1 lb. wettable DDT per 100 U.S. gals. was applied to paper towelling and allowed to weather, the deposits lost most of their toxicity to adults of *C. molesta* in less than three weeks, but remained highly toxic to those of *Macrocentrus ancylivorus* Rohw. for five weeks. Similar results were obtained when adults of *C. molesta* and *M. ancylivorus* were caged over small peach trees that had been treated with the same spray. The insecticide failed to prevent infestation of the twigs by the first two generations of *C. molesta* and completely eliminated parasitism of the larvae for a few days. Although mortality of adult parasites released on sprayed trees continued for up to 34 days after spraying, some that were released 19 days after it caused effective parasitism of the larvae.

In laboratory tests with immature apples from sprayed orchards, DDT residues were highly toxic to adults of *M. ancylivorus* and *Angitia* (*Horogenes*) *molestae* (Uch.), but only slightly so to those of *Phanerotoma grapholithae* Mues., *Agathis festiva* Mues. and *C. molesta*. Low residues of parathion were extremely toxic to *Angitia*, *Phanerotoma* and *C. molesta* but not to *Agathis*, and very low ones, which did not affect *Angitia* or *Phanerotoma*, appeared to cause a heavy delayed mortality of *C. molesta*, which did not become noticeable until after exposure for 96 hours.

Cox (H. C.), Fahey (J. E.) & Brindley (T. A.). **European Corn Borer Control in Relation to Malathion Residues.**—*J. econ. Ent.* **50** no. 1 pp. 52–55, 2 graphs, 8 refs. Menasha, Wis., 1957.

In tests with malathion applied at 1 and 2 lb. in 10 U.S. gals. spray per acre for the control of *Pyrausta nubilalis* (Hb.) on field maize in Iowa in 1954, wettable powders usually gave better reductions in numbers of larvae than emulsion concentrates, and 2 lb. malathion per acre was significantly more effective than 1 lb. Applications were made 1–3 times at 5-day intervals, between 18th June and 8th July, and, in general, three were more and one less effective than two; one application was most effective when applied on 23rd June, two on 23rd and 28th June, and three when these two dates were included. Almost 70 per cent. of the larvae hatched between these two dates, and the percentage of plants showing leaf feeding rose from 30 to 90. The most effective treatment (wettable malathion at 2 lb. applied on 18th, 23rd and 28th June) reduced the number of larvae per 100 plants from 354 to 60. Insecticide residues on the plants were much higher after treatment with 2 lb. than with 1 lb. malathion and higher from emulsions than from wettable powders, though the latter persisted longer. However, all residues disappeared almost entirely in five days, which accounts for the relatively poor control given by treatments made before 23rd June, when few larvae had hatched.

Malathion at 2 lb. and DDT at 1·5 lb. per acre were compared in granules and emulsion sprays applied 1–3 times to sweet maize in 1955 [*cf. R.A.E.*, A **46** 56]. Hatching increased rapidly between 14th and 19th June, and treatments gave the best results when applied on dates including 19th June. DDT was more effective than malathion, but there were no differences between formulations. The best control was given by three applications, on 14th, 19th and 24th June, the numbers of larvae per 100 plants being reduced from 161 to 16 and 29 by DDT sprays and granules and to 34 and 43 by malathion sprays and granules. Malathion residues were lower from granules than from emulsions, but were slightly more persistent, either because of the more protected situation in which they collected or because the Celite carrier used releases the toxicant slowly; residues from sprays were greatest on the tips of whorl leaves and on stalk leaves and those from granules in the whorls and in the leaf axils [*cf.* **46** 57].

Karlin (E. J.), Naegele (J. A.) & Johnson (G. V.). **Screening Greenhouses with Insecticide-impregnated Cloth for Thrips Control.**—*J. econ. Ent.* **50** no. 1 pp. 55–58, 3 refs. Menasha, Wis., 1957.

In tests carried out in New York in 1954 and 1955, the top and side vents or side vents only of greenhouses in commercial rose production were screened from May until August with cheesecloth impregnated with solutions of 25 per cent. dieldrin or 15 per cent. heptachlor or malathion, to determine whether thrips that penetrated the screening would be killed by the insecticides. The numbers of thrips found in the flowers varied greatly from day to day. *Frankliniella tritici* (Fitch) was the principal species present, but four others occurred in small numbers, and all, whether living or dead, were included in analysing the results. These showed that only the dieldrin treatment gave consistently significant reductions in numbers; malathion was effective when used on top and side vents, but not on the side vents only, and heptachlor proved inconsistent. It is considered that spraying the cloth once or twice during the season might be advisable to maintain or improve control.

Atkins jr. (E. L.), Frost jr. (M. H.), Deal (A. S.) & Reynolds (H. T.). **The Omnivorous Leaf Roller, *Platynota stultana* Wlshm., on Cotton in southern California: Damage and Control.**—*J. econ. Ent.* **50** no. 1 pp. 59–64, 1 fig., 4 refs. Menasha, Wis., 1957.

Platynota stultana Wlsm. caused serious damage to more than 30,000 acres of cotton in the Imperial Valley of California in 1954 and some damage in other places. The larvae feed on the leaves, terminals, squares and bolls, causing a reduction in yield, and in one instance caused more injury to the bolls than did *Heliothis zea* (Boddie). High populations are maintained throughout the year on a succession of plants, and control is difficult because the larvae conceal themselves in nests of webbing between plant parts or in rolled leaves, the other stages are resistant to insecticides, the life-cycle varies considerably in length, and insecticide residues soon lose their toxicity, owing to the high temperatures prevailing in the area.

In tests with 27 insecticides, applied once in 10–19 U.S. gals. spray or 25–50 lb. dusts with ground machines in August, 3–5 lb. DDT (with toxaphene), 0·5–2·12 lb. parathion or 2·5 lb. Perthane [1,1-bis(p-ethylphenyl)-2,2-dichloroethane (ethyl-DDD)] per acre gave effective reductions in numbers of larvae, and 2 lb. Dilan [a 1:2 mixture of 1,1-bis(p-chlorophenyl)-2-nitropropane and 1,1-bis(p-chlorophenyl)-2-nitrobutane], 4·5 lb. DDD and 1·8 lb. Chlorthion [O,O-dimethyl O-3-chloro-4-nitrophenyl phosphorothioate] were promising, but the others, including BHC and toxaphene, were ineffective; 1·56 lb. methyl-parathion or parathion and 4·7 lb. DDT were effective in 3 U.S. gals. spray per acre, applied by aeroplane. In tests in September, three applications at weekly intervals of 3 lb. DDT (alone or with BHC or toxaphene) or 0·5 lb. parathion in 10 U.S. gals. spray per acre gave effective control and were better than two applications of the same sprays, and, in view of restrictions on the use of parathion, DDT at 3 lb. per acre, applied three times at weekly intervals in sprays or, possibly, dusts, is recommended against medium or heavy infestations; such treatment resulted in 23·8 per cent. increase in yield.

Riehl (L. A.), Jeppson (L. R.) & Wedding (R. T.). **Effect of Timing of Oil Spray Applications during the Fall on Juice Quality and Yield of Lemons in two Orchards in southern California.**—*J. econ. Ent.* **50** no. 1 pp. 74–76, 10 refs. Menasha, Wis., 1957.

In the experiments described, which were carried out in 1952–55, lemon trees in two orchards each received one spray of oil emulsion and one of 1 lb. 50 per cent. wettable ovex [p-chlorophenyl p-chlorobenzenesulphonate] per 100 U.S. gals. each year. The emulsions contained 1·75 per cent. light-medium oil (92·5 per cent. unsulphonated residue) and were applied to run-off in the first weeks of August, September, October, November, December or January, and the ovex sprays were applied about six months later. Analyses of fruit juice in 14 samples taken at intervals during the experiment and yield records in 1955 showed no differences beyond the limits of natural variation. It is therefore concluded that oil sprays do not reduce juice quality or yield of lemons in southern California if applied correctly within the period tested.

STRONG (R. G.) & RAWLINS (W. A.). **Mass Rearing of Six-spotted Leafhoppers.**—*J. econ. Ent.* **50** no. 1 pp. 76–79, 4 figs., 1 ref. Menasha, Wis., 1957.

In connection with studies in New York on the protection of lettuce from infection with the aster-yellows virus by control of the vector, *Macrosteles fascifrons* (Stål), mass rearing methods were developed to supply populations of the Cicadellid for tests of insecticides. From September to May, rearing was carried out in a greenhouse at temperatures of 70–80°F., with an occasional rise to 90° for a short time on bright days, in cages with cellulose acetate frames covered with nylon tulle or marquisette. Barley and China aster [*Callistephus chinensis*] were used as food-plants, but infestation of these by other pests made it necessary to transfer the adults to fresh plants every 4–7 days and the nymphs occasionally; the methods adopted are described. In June–August, the insects were reared under approximately natural conditions in outdoor insectaries. The same rearing procedures were followed as in the greenhouse, but the plants grew more vigorously and fewer transfers of nymphs were necessary, the life-cycle being completed on one plant in many instances.

O'BRIEN (R. D.). **The Effect of Malathion and its Isomer on Carbohydrate Metabolism of the Mouse, Cockroach and House Fly.**—*J. econ. Ent.* **50** no. 1 pp. 79–84, 2 figs., 20 refs. Menasha, Wis., 1957.

As it had been shown [*R.A.E.*, A **45** 350] that malathion (O,O-dimethyl S-(1,2-di(ethoxycarbonyl)ethyl) phosphorodithioate) may exercise its toxic effect on insects by some property other than anticholinesterase activity, and that succinoxidase inhibition is apparently not involved, the effects of malathion and isomalathion (O,S-dimethyl S-(1,2-di(ethoxycarbonyl)ethyl) phosphorodithiolate) [*cf. loc. cit.*] on some enzymes involved in carbohydrate metabolism were studied in mouse brain, in the muscle tissue of the American cockroach (*Periplaneta americana* (L.)) and in whole house-flies (*Musca domestica* L.). Isomalathion was included because its behaviour may be similar to that of "malaoxon" (O,O-dimethyl S-(1,2-di(ethoxycarbonyl) ethyl) phosphorothiolate), which is probably a primary metabolic product of malathion metabolism in insects and mammals, and may entirely account for the toxic effect of malathion on them [**45** 186].

The following is based on the author's summary of the results. Malathion and isomalathion had quite a strong inhibitory effect on pyruvate oxidation in mouse brain, perhaps through interference with the citrate oxidising system. Apart from this, they did not substantially inhibit the tricarboxylic acid cycle pathways of carbohydrate metabolism in mouse brain or tissue of the cockroach (or house-fly where observations were possible). Furthermore, the results showed generally smaller inhibitions for insect than for mouse enzymes. Since malathion is far more toxic to insects than to mammals, it is unlikely that the interferences with carbohydrate metabolism have any connection with the insecticidal action of the compound.

CORY (E. N.) & HIGHLAND (H. A.). **Control of some Pests of Ornamentals.**—*J. econ. Ent.* **50** no. 1 pp. 86–89, 8 refs. Menasha, Wis., 1957.

In 1953, malathion and DDT were tested in emulsion sprays for the control of *Psylla buxi* (L.) on box [*Buxus*] in Maryland. Spraying hedges with 1 quart 50 per cent. malathion per 100 gals. on 11th May caused considerable reduction of Psyllids by 11th June, and repeating the treatment on 8th July practically eliminated them; spraying with 1·5 quarts 30 per cent. DDT per 100 gals. on the first date appeared rather less effective. Thorough application of the malathion spray to very old plants on 29th July eliminated a heavy infestation by the end of the month, and the plants were still free from the Psyllid on 31st August. Preliminary laboratory tests in 1954 indicated that malathion would kill the immature Psyllids in the leaf buds, and spraying with 1·5 quarts 50 per cent. malathion per 100 gals. on 21st April, when the insects showed wing buds and long strands of waxy secretion, or on 29th–30th April, when many of them were exposed on the flat surfaces of the new leaves, resulted in very low catches after periods of two months and a week, respectively, but the spray at the end of April was applied too late to prevent early curling of the new leaves. Unsprayed hedges remained infested. In 1955, treatment with the malathion spray on 28th April, when the waxy secretion was visible, resulted in 3·6 and 3 Psyllids per 25 sweeps of the net on 26th May and 7th June, respectively, and a further treatment on 16th June in none on 19th July. Treatment of other hedges with 1·82 quarts 50 per cent. malathion per 100 gals. on 16th June reduced the infestation from 5·6 and 5·5 Psyllids per 25 sweeps on 26th May and 6th June, respectively, to 1 on 22nd June. Although good control had apparently been obtained in 1954, injury was fairly extensive on the sprayed hedges in 1955, indicating the occurrence of reinfestation from unsprayed plants. As it is evident that the adults can be almost eliminated with malathion and a considerable period elapses between adult emergence and oviposition [*cf.* *R.A.E.*, A **35** 263], a spray in early June, before oviposition begins, should give effective control.

Preliminary experiments in 1953 indicated that high doses of Systox [diethyl 2-(ethylthio)ethyl phosphorothioate (demeton)] applied to the foliage of box or the soil under the plants in March were effective against last-instar larvae of *Monarthropalpus buxi* (Lab.), whereas schradan was not. In tests in 1955, spraying the foliage to run-off with 2 pints of a 26·2 per cent. demeton concentrate per 100 gals. or applying the concentrate at 15–37·7 ml. in 3 U.S. quarts water to the soil round the trunk, in June or on 1st September, eliminated the Cecidomyiid, whereas spraying with 1 pint 90 per cent. schradan per 100 gals. or treating the soil with 10 ml. of the schradan concentrate in water did not.

Against *Unaspis euonymi* (Comst.) on *Euonymus*, an emulsion spray of 1 per cent. malathion was applied to heavily infested bushes on 22nd April and 1st May 1953 to determine whether the insecticide would penetrate the scales and kill the overwintering females. On 9th June, there were up to 26 living adults and 38 nymphs per twig on treated bushes and practically no insects on the leaves, whereas there were up to 59 females on untreated twigs and 102 and 248 nymphs, respectively, on an inch of untreated twig and an untreated leaf. Treatment with 1·5 quarts 50 per cent. malathion per 100 gals. on 11th June 1953, with 1 quart summer oil and 1 quart 30 per cent. DDT per 100 gals. on 20th May 1954, with 1 U.S. quart 50 per cent. malathion and either 2·5 lb. 50 per cent. wettable DDT or 1 U.S. quart summer oil per 100 U.S. gals. or with 1 lb. 40 per cent. DNC per 100 U.S. gals. on 3rd March 1955 caused some reduction in population.

Systemic insecticides were tested for the control of *Phytomyza ilicicola* Lw. (*ilicis*. auct.) on heavily infested American holly (*Ilex opaca*) in 1955–56. In June 1955, emulsion concentrates containing 26·2 per cent. demeton or 90 per cent. schradan were painted in bands 4–6 ins. wide on the trunk, just below the lowest branch, or applied to the soil round the trees at 30 ml. per plant in 1 U.S. gal. water. Examination in April 1956 showed that demeton was effective in both treatments, whereas schradan was effective only when applied to the soil. Examination of trees in a commercial nursery at the end of February 1956 showed that treating the trunks with demeton in June 1955 had practically eliminated *P. ilicicola*, whereas hedges that had been sprayed with 0·1 per cent. actual schradan or demeton in July 1953 had many mined leaves in April 1954.

FORBES (A. R.) & KING (K. M.). **Control of Root Maggots in Rutabagas, especially in Muck Soils.**—*J. econ. Ent.* **50** no. 1 pp. 89–91, 9 refs. Menasha, Wis., 1957.

Insecticide treatments that give good control of *Hylemyia* spp. attacking swedes in mineral soils in British Columbia [*R.A.E.*, A **45** 267, etc.] are ineffective in muck soils there, and heptachlor was therefore tested at the standard and at increased rates of application against *H. brassicae* (Bch.) in both muck and mineral soils in 1955 by methods already described [**44** 241]. In mineral soils containing 9 per cent. organic matter, band treatment with 5 lb. heptachlor per acre in a 2·5 per cent. dust, 2·5 per cent. granules or an emulsion concentrate gave 93–95 per cent. reduction in damage, and two dilute emulsion-spray applications of 1·5 lb. heptachlor per acre gave 99 per cent.; two spray applications of 1·5 lb. heptachlor at twice the concentration or one of 3 lb. heptachlor per acre applied just after thinning gave 89 and 79 per cent. reduction, respectively. In muck soils containing 49 per cent. organic matter, two dilute applications of 1·5, 2·5 and 3·5 lb. heptachlor per acre gave only 43, 56 and 62 per cent. control. These results, and observations in experimental and commercial plantings in earlier years, indicate that the insecticides would be ineffective in soils containing more than 20 per cent. organic matter, unless applied at extremely high dosages, and results given by sprays of heptachlor or aldrin in 1950–55 showed a highly significant negative correlation between percentage of organic matter in the soil and reduction in plant injury. This may be due partly to adsorption by the organic matter and partly to the habit of the insects of ovipositing at greater depths and nearer to the plants in loose soils than in heavier ones, so that the newly hatched larvae are less likely to come in contact with a lethal amount of insecticide before reaching the plants.

YUST (H. R.). **Biology and Habits of *Pagiocerus fiorii* in Ecuador.**—*J. econ. Ent.* **50** no. 1 pp. 92–96, 2 refs. Menasha, Wis., 1957.

Pagiocerus fiorii (Egg.) is the most serious pest of stored soft maize in the mountain valleys of Ecuador, where it was previously misidentified as *P. frontalis* (F.) [*cf. R.A.E.*, A **42** 266]; it apparently attacks no other crop there, and reports of its reproduction in avocado seeds probably refer to a species of *Thamnophthorus*. Both larvae and adults feed on maize, and infestation begins in the field. Investigations in the laboratory in 1954–55 on the bionomics of the Scolytid showed that the females deposit about 80 eggs each in groups of 2–7 in the kernels, apparently in the powder produced by feeding. The larvae feed voraciously and pupate within the grains, and up to 27 larvae or 12 pupae were found in single kernels. The period from adult emergence to pupation of the next generation averaged 37·2 days, and the pupal stage eight days. The complete life-cycle lasted 42–150 days, and the adults lived for about 2–16 days without food and 18–102 days with it; the ratio of males to females was 1:2. The average number of progeny surviving to the adult stage was 75 per female, so that populations increased rapidly. All stages of *P. fiorii* are briefly described.

Bann (J. M.), DeCino (T. J.), Earle (N. W.) & Sun (Yun-pei). **The Fate of Aldrin and Dieldrin in the Animal Body.**—*J. agric. Fd Chem.* **4** no. 11 pp. 937–941, 28 refs. Easton, Pa., 1956.

Davich (T. B.), Tombes (A. S.) & Carter (R. H.). **Insecticide Control of Green June Beetle Larvae attacking Ladino Clover Pastures: Residues on Foliage and Accumulation in Swine Tissue.**—*J. econ. Ent.* **50** no. 1 pp. 96–100, 5 refs. Menasha, Wis., 1957.

In the first of these papers, the authors review the literature on the fate of chlorinated insecticides in the body of mammals and point out that heptachlor has been found to be oxidised to heptachlor epoxide in animals and stored as such. Studies on the fate of aldrin and dieldrin were begun because tests by bioassay techniques [*R.A.E.*, A **42** 283, etc.] indicated the presence of larger quantities of toxicant in the milk of cows and the fat of rats that had been fed with aldrin than did a phenyl-azide colorimetric method of analysis, specific to aldrin, from which it was concluded that the aldrin had undergone a structural change within the animals, possibly (on analogy with heptachlor) to dieldrin. Subsequent comparison of the results obtained by these methods, analyses for total organic chlorine and analyses by a colorimetric method specific to dieldrin showed that butter from cows fed with aldrin, the fat of beef cattle and sheep into which aldrin had been injected subcutaneously, the fat of pigs that had been fed on hay treated with aldrin and eggs from hens fed with aldrin all contained dieldrin, and this conclusion was supported by the infrared spectra. Some also contained very small quantities of aldrin, and the sum of the residues found by the methods specific to aldrin and to dieldrin approximated to the total found by bioassay, indicating that no unidentified toxic compound was present in significant quantities. Epoxidation of aldrin to dieldrin in the body apparently takes place readily, as dieldrin was found in the milk of cows within 24 hours after they had ingested aldrin. Analysis for dieldrin, by all available methods, of butter from cows fed with dieldrin and of fat from beef cattle that had received a subcutaneous injection of it yielded results that were in good agreement, indicating that dieldrin accounted for all the toxicity in the samples and is stored unchanged in the animal body.

The second paper contains the results of investigations in Virginia in 1953–55 in which granular insecticides were applied against young larvae of *Cotinis nitida* (L.) injuring mixed pastures, to determine the lowest effective dosage, the duration of the insecticidal effect and the rate of accumulation of the compounds in the fat of pigs that grazed on the pasture. Sampling variation and migration of larvae into the treated plots after the dissipation of the toxicant caused some inconsistency in the results, but dieldrin at doses as low as 0·4 lb. and aldrin or heptachlor at 1 lb. per acre usually gave effective control of larvae in the second instar and should be extremely effective against those in the first if applied shortly after hatching. Endrin, isodrin, toxaphene and DDT gave complete or almost complete control of the first instar at 0·25, 0·2, 2 and 2 lb., respectively, and of the second instar at 0·5, 0·5, 2·9 and 3·4 lb., and chlordane gave complete control of the second at 2·7 lb., but 2·9 lb. malathion was ineffective. When aldrin was applied in 1955 at 0·5–2·4 lb. per acre, dusts resulted in higher initial foliage residues than granular formulations on attapulgite or vermiculite, but the residues from applications of 2·1–2·4 lb. actual compound per acre in all three formulations exceeded 0·1 part per million after 14 days, though they were probably below this after 21 days.

In 1953, young pigs were allowed to graze for 76 days on pastures that had been treated with 1·9–14·8 lb. aldrin per acre in granules, after which they were slaughtered. Specific analysis of the fat back for aldrin showed none, whereas specific analysis for dieldrin, bioassay, and analysis based on total organic chlorine showed 0·2–1·82, 0·4–2·7 and 2–2·2 p.p.m., respectively. In 1954, analysis by the organic-chlorine method showed accumulations of 0·1–3 p.p.m. dieldrin, 0·9 p.p.m. heptachlor and 1 p.p.m. toxaphene in the subcutaneous fat of pigs that grazed for 119–133 days on pasture treated with 1·7–3·9, 3·6 and 16 lb. per acre, respectively, of these compounds. Specific analyses for aldrin and dieldrin showed none in the fat of animals that grazed on pasture treated with aldrin at 2 or 4 lb. per acre, though a residue of 0·4–0·5 p.p.m. was indicated by the organic-chlorine method for the higher rate of application.

Bibby (F. F.). **Field Tests of insecticidal Sprays for Control of Cabbage Looper on Lettuce.**—*J. econ. Ent.* **50** no. 1 pp. 101–102. Menasha, Wis., 1957.

Field-plot tests on the control of *Trichoplusia ni* (Hb.) on lettuce in the Salt River Valley of Arizona were carried out in the autumn of 1956, emulsion sprays being applied. Control was not satisfactory when 2 lb. toxaphene, 1 lb. DDT or a mixture of both was applied in 10 U.S. gals. spray per acre, but was improved by doubling the rates per acre, except for toxaphene alone, which was still ineffective at 4 lb. in 20 U.S. gals. per acre. Malathion at 1 lb. with 1 lb. Perthane [1,1-bis(p-ethylphenyl)-2,2-dichloroethane (ethyl-DDD)] in 20 U.S. gals. spray per acre gave excellent control, though neither material was satisfactory alone, even at increased rates of application.

Robertson (O. T.). **Occurrence of the Boll Weevil in the Big Bend of Texas.**—*J. econ. Ent.* **50** no. 1 p. 102. Menasha, Wis., 1957.

An outbreak of *Anthonomus grandis* Boh. on cotton occurred in the upland counties of Brewster and Presidio, in the Big Bend area of Texas, in 1953–55, more than 200 miles west of the cotton-producing areas in which damage is normal and about 100 miles from the nearest infestation in Mexico. The weevil was rare in this district before 1953, when an infestation in early November damaged late bolls. Periodic surveys in 1954 showed practically no infestation until September, when 70–96 per cent. of the squares were punctured in one area and insecticides were applied. In 1955, adults were found from 7th June and punctured squares from 23rd June, and high proportions of squares were punctured by mid-August in fields in which no insecticide had been used. By 20th–21st September, weevils were found in all fields sampled between Castolon and Candelaria, and 8–100 per cent. of the squares showed egg punctures.

Hensley (S. D.) & Arbuthnot (K. D.). **Migration of Larvae of Southwestern Corn Borer on Corn.**—*J. econ. Ent.* **50** no. 1 p. 103, 4 refs. Menasha, Wis., 1957.

The movements of larvae of *Zeadiatraea grandiosella* (Dyar) on maize plants were investigated in Oklahoma in June and July 1955, with a view to improving the timing of insecticidal applications for their control [*cf.* *R.A.E.*, A **43** 249–250]. On 18th June, egg-masses that had been deposited four days previously were used to infest maize plants about 38 ins. high. They were put on the stalks, at heights of about 3 and 18 ins. and immediately below the whorl, and on the lowest, middle and uppermost unfurled leaf, and the percentage hatch was recorded after 24 hours. It averaged 82·6, and no eggs hatched later, about 4 per cent. being parasitised by *Trichogramma minutum* Ril. Dissection of plants on 11 days between 20th June and 6th July showed that all the larvae migrated during the first instar to the whorls, probably because they afforded adequate moisture and tender plant tissue for feeding, and remained there until the third, by which time the leaves were fully unfurled and the tassels exposed. They then began to tunnel into the stalks below the ear zones, and all were found within the stalks or entering them during the fourth and fifth instars. It was not determined whether the third-instar larvae changed their position because the whorl became unsuitable for feeding or because they are inherently disposed to migrate.

WALTER (E. V.). **Corn Earworm lethal Factor in Silks of Sweet Corn.**—*J. econ. Ent.* **50** no. 1 pp. 105–106. Menasha, Wis., 1957.

In certain plants of some inbred selections of maize tested in the United States, newly hatched larvae of *Heliothis zea* (Boddie) that were put among the fresh silks died after feeding for short periods, apparently owing to a lethal factor in the silks. All crosses between such inbred plants were resistant to the earworm, and many had dead larvae in the silks; dead larvae occurred in 10–20 per cent. of the ears of a few crosses between these and susceptible inbred lines, and inbreds selected from crosses having the lethal character in one or both inbred parents frequently had dead larvae, indicating that the character could be transmitted by breeding.

Occasionally, larvae reached the ears and fed on the mature kernels after others had died in the fresh silks, indicating that the lethal factor may be due to some substance that is lost or changed as the silks mature. Maize kernels that had been dipped in a water suspension of dead larvae removed from the silks had no lethal effect on healthy young larvae that fed on them in cages in two seasons. The fact that certain inbred lines show the lethal character every year, whereas most others have never shown it, suggests that the death of the larvae in the silks is not due to virus or bacterial infection.

SRIVASTAVA (P. D.). **Control of** *Hieroglyphus nigrorepletus* **Bol.**—*J. econ. Ent.* **50** no. 1 pp. 106–107, 6 refs. Menasha, Wis., 1957. **Susceptibility of different Parts of the Body of** *Hieroglyphus nigrorepletus* **Bol. to the Entry of Insecticides.**—*T. c.* pp. 108–109, 3 refs.

In the first of these papers, the author describes laboratory experiments in which nymphs and adults of *Hieroglyphus nigrorepletus* Bol., which are injurious to sorghum and other crops in India, were dusted with 5 per cent. BHC and provided with untreated sorghum leaves. Mortality was in inverse relation to the age of the grasshoppers, ranging from 65 and 98 per cent. after 24 and 72 hours, respectively, for first-instar nymphs to 13 and 91 per cent., respectively, for adults.

In the second, he records tests in which the hind legs of adults of both sexes (brachypterous form) were treated with 0·06 cc. of emulsions containing 0·1–0·5 per cent. aldrin. The application of 0·5 per cent. aldrin to the coxa, trochanter, femur or tibia caused up to 30 per cent. mortality, and application to the tarsus up to 50 per cent., whereas treatment of the pretarsus with 0·1, 0·2 and 0·3 per cent. aldrin resulted in averages of 6, 20 and 60 per cent. mortality in 72 hours and treatment with 0·4 and 0·5 per cent. aldrin in 90 and 98 per cent.

HAMSTEAD (E. O.) & GOULD (E.). **Relation of Mite Populations to seasonal Leaf Nitrogen Levels in Apple Orchards.**—*J. econ. Ent.* **50** no. 1 pp. 109–110, 6 refs. Menasha, Wis., 1957.

Since 1946, mite populations in a fruit-growing area in West Virginia have been noticeably greater in apple orchards maintained in vigorous condition, and the effect of tree vigour was therefore studied in 1953 and 1954. In an orchard in which different amounts of nitrogenous fertiliser were broadcast under groups of trees on 19th February 1953, but all other treatments were uniform, counts of mites from leaf samples taken once a fortnight from 4th May to 16th September and chemical analyses of the leaves showed more than twice as many eggs and later stages of *Tetranychus telarius* (L.) on leaves containing 1·88 per cent. nitrogen as on those containing 1·75 per cent., but no significant differences in the numbers of *Metatetranychus ulmi* (Koch). Contents of phosphorus, potassium, calcium and magnesium showed no clear relations to mite populations. In 1954, the numbers of *T. telarius* were negligible, but there were 29 per cent. more active examples of *M. ulmi* and 37 per cent. more eggs on leaves containing 2·02 per cent. nitrogen than on those containing 1·5 per cent. The seasonal peak in mite populations followed within about a fortnight after the seasonal peak of leaf-nitrogen, and it appears that a high nitrogen content might induce a harmless population to increase until it becomes destructive and difficult to control and might mask the effect of sprays.

CARTIER (J. J.). **On the Biology of the Corn Leaf Aphid.**—*J. econ. Ent.* **50** no. 1 pp. 110–112, 2 figs., 7 refs. Menasha, Wis., 1957.

In 1954–55, alarming outbreaks of *Aphis* (*Rhopalosiphum*) *maidis* Fitch on late barley were reported from the central and eastern provinces of Canada. This Aphid overwinters in latitudes south of northern Texas, and the alate viviparous females are believed to migrate north as the weather becomes favourable in spring. Reproduction appears to be exclusively parthenogenetic in nature, but a few males were obtained in experiments in Arizona in 1914–24 [*cf. R.A.E.*, A **20** 674]. In the course of investigations in Kansas on resistance to the Aphid in sorghum [*cf.* **45** 352], one of the two biotypes studied (KS-1) gave rise to small numbers of males in the greenhouse in the spring of 1955. They were larger in size when the Aphid population was small and the food-plant in normal growing condition. The males obtained are described and figured; the other biotype produced none.

In the greenhouse, the Aphids were inactive at a temperature of 60°F., but were active and excreted honeydew at 75°; the optimum for flight appeared to be 74°F., and very few flew at temperatures above 82°. They came to lights at night in the greenhouse at temperatures of 70–75°, and survived temperatures as high as 110°F. Alate females were found to bear as many as seven examples of *Ercynetes* sp., a mite that was abundant in the greenhouse.

MARCOVITCH (S.). **Forecasting Armyworm Outbreaks—a Possibility.**—*J. econ. Ent.* **50** no. 1 pp. 112–113. Menasha, Wis., 1957.

Pseudaletia unipuncta (Haw.) hibernates in the larval stage in grassy areas. The adults of the overwintered generation oviposit in grain fields in April and give rise to larvae that are responsible for the outbreaks that are common in spring. In Tennessee, these generally occur in May, but the larvae are present throughout the season, as there are five generations a year. The larvae are normally controlled by parasites, of which the most important is *Apanteles militaris* (Walsh), and outbreaks occur in the absence of this Braconid. Dry weather appears to be detrimental to it, and outbreaks have usually occurred in years following droughts. Although Tennessee has a high rainfall, periods during which there is less than 0·25 inch rain in 21 days or more are frequent in June–October, and the occurrence of such droughts apparently hinders the development of *A. militaris* and may result in an armyworm outbreak in the next year. Investigations on the temperature and moisture requirements of the parasite should enable outbreaks to be forecast.

Tomlinson jr. (W. E.). *Eriococcus azaleae* **Comst. and** *Cerococcus kalmiae* **Ferris on Cranberry.**—*J. econ. Ent.* **50** no. 1 pp. 113–114, 2 figs., 1 ref. Menasha, Wis., 1957.

Since 1952, *Eriococcus azaleae* Comst. has proved less injurious to cranberry in Massachusetts [*cf. R.A.E.*, A **40** 386] than *Cerococcus kalmiae* Ferris, which has required control in three bogs. Damage by either occurs only in bogs that are not flooded, and is therefore not common. Both these Coccids have one generation a year. *C. kalmiae* oviposits in autumn and overwinters in the egg stage; the crawlers hatch in the second half of May and migrate to leaf nodes on old or new growth, giving rise to adults in late summer. *E. azaleae* overwinters as a partly grown nymph, usually in plant crotches, and the adults emerge and the eggs are laid in spring. The crawlers hatch in late June.

Sprays of 0·125 per cent. of emulsion concentrates containing 45 per cent. EPN [ethyl O-p-nitrophenyl phenylphosphonothioate], 33·3 per cent. Metacide [methyl-parathion and parathion] and 57 per cent. malathion, and of 2 lb. 18 per cent. wettable parathion per 100 U.S. gals., applied at about 400 U.S. gals. per acre to give complete coverage of the plants, gave almost complete control of newly settled crawlers of *C. kalmiae* and did not injure the cranberry plants.

Peterson jr. (G. D.). *Lamprophorus tenebrosus* **introduced into Guam to combat the Giant African Snail.**—*J. econ. Ent.* **50** no. 1 p. 114, 3 refs. Menasha, Wis., 1957.

The author describes the methods by which larvae of *Lamprophorus tenebrosus* (Wlk.) were transported by air from Ceylon to Guam [*cf. R.A.E.*, A **45** 230] in February and March 1955, for release against the giant African snail, *Achatina fulica*. In the laboratory, the larvae consumed young individuals of *Achatina* entirely, one destroying eight, 20–40 mm. in length, in ten days; even when starving, they did not attack larger snails or living adults of the predacious snail, *Gonaxis kibweziensis*, which had been introduced against *Achatina* from the Mariana Islands in September 1954. In another test, in which young larvae of *Lamprophorus* were confined with young examples of *Achatina* and *Gonaxis* of about equal size, they consumed such *Achatina* as were not destroyed by *Gonaxis* but made no attempt to attack the latter, though caged with them until they died of starvation. Larvae of *L. tenebrosus* were liberated in four localities, but surveys made several months later showed no evidence of establishment.

Boyle (W. W.). **On the Mode of Dissemination of the Two-spotted Spider Mite,** *Tetranychus telarius* **(L.) (Acarina: Tetranychidae).**—*Proc. Hawaii. ent. Soc.* **16** no. 2 pp. 261–268, 3 refs. Honolulu, 1957.

The author reviews a recent finding that, unlike other Tetranychids, *Tetranychus telarius* (L.) does not spin down from the leaves of infested plants or drift away from them on air currents [*R.A.E.*, A **45** 429] and describes experiments in Hawaii in 1955–56 on the mode of dispersal of this mite. In laboratory tests, *T. telarius* increased in numbers on a bean plant until all the leaves were dead or began to droop, but did not spin down and made no attempt to migrate from it along the ground. Air currents generated by a fan operated at moderate speed carried individual mites from an infested plant to adhesive-coated slides 3–4 ft. away. In the field, there was also no movement along the ground from infested plants, and the spread of infestation from a given point in a plot of beans occurred in direct relation to the prevailing wind; the advance was relatively rapid in the direction of the wind and very slow against it, progress in this latter direction probably resulting from reverse gusts. Up to 48 mites of all stages were taken on microscope slides placed vertically 3 ft. downwind from infested plants. It is concluded that *T. telarius* is normally disseminated by wind, but that stronger currents are needed than for species that spin down from the plants and thus provide themselves with a parachute-like filament. Wind-carriage is not restricted to adult females.

NAMBA (R.). *Cryptophlebia illepida* **(Butler) (Lepidoptera: Eucosmidae) and other Insect Pests of the Macadamia Nut in Hawaii.**—*Proc. Hawaii. ent. Soc.* **16** no. 2 pp. 284–297, 2 figs., 8 refs. Honolulu, 1957.

Macadamia nuts (*Macadamia ternifolia*) have been grown on an increasing scale in Hawaii since 1922. The crop is attacked by relatively few insects, and of these the most important is the indigenous *Cryptophlebia illepida* (Btlr.), the immature stages of which are described. The eggs of this moth are laid on the husks of the fruits and hatch in 3–5 days. The larvae bore through the husk to the shell and later sometimes penetrate this and reach the kernel, causing young fruits to drop or to dry up on the tree. Up to seven larvae were seen in a single fruit, and they sometimes leave one fruit and enter another. The larval stage lasts about 16 days, and pupation occurs in the husks of the nuts, which have usually fallen by the time this stage is reached. The adults emerge about ten days later and pair soon after. In special observations, the oviposition period lasted up to six days, and the maximum numbers of eggs laid per female were 367 and 328.

In studies on larval feeding, older larvae completed development on fully matured kernels, but those in the first three instars did not. The larvae appeared unable to bore through shells that had already hardened, and damage to the kernels was usually only partial, so that their commercial value was not completely destroyed. Fruits suitable for infestation are present throughout the year. In the only planting (on Oahu) in which damage was significant, the percentage infestation of the husks reached 60 in July–September, and that of the kernels was highest (about 15) in June, when proportionally more of the fruits had penetrable shells than at other times of the year.

The alternative food-plants of *C. illepida*, a list of which is given, include *Acacia koa*, of which it destroys a high proportion of the seeds, and third-, fourth- and fifth-instar larvae infesting *M. ternifolia* and *A. koa* on Oahu were found to be parasitised by the Ichneumonids, *Angitia* (*Horogenes*) *chilonis* (Cushm.), *Pristomerus hawaiiensis* Perkins, and *Pimpla* (*Coccygomimus*) *punicipes* Cress. Other parasites of the species are listed. Although these afford some control, other measures are desirable, and cultural methods to reduce infestation are suggested. Other pests of *Macadamia* in Hawaii are of little importance and are very briefly reviewed.

PARHAM (J. W.), MUNE (T. L.) & O'CONNOR (B. A.). *Lantana* **and its Control in Fiji.**—*Agric. J. Fiji* **27** no. 1–2 pp. 28–32, 5 figs., 3 refs. Suva, 1956.

Lantana camara is a noxious weed in Fiji, and insects have been introduced for its control, hitherto with little success [*cf. R.A.E.*, A **24** 447]. In 1952, Fiji joined with Australia and Hawaii in a project to import further insects against the weed, and several species were introduced into Hawaii from Mexico and reared. The first to be subsequently imported into Fiji were *Blepharomastix acutangularis* (Sn.), in June 1954, and *Diastema tigris* Gn., in October 1954. The larvae of these moths feed on the leaves, and both were released in the field.

O'Connor (B. A.). **Notes on the Control of *Oryctes rhinoceros* L. by the Use of Insecticides.**—*Agric. J. Fiji* **28** no. 1–2 pp. 15–18, 2 figs., 2 refs. Suva, 1957.

Details are given of improvements that have been made in the methods used for the control of *Oryctes rhinoceros* (L.) on coconut in Fiji [*cf. R.A.E.*, A **44** 419, etc.]. A special funnel was devised for the application of the mixture of BHC and damp sawdust to the axils of the youngest fronds in the crowns of the palms, and several other insecticides were tested in the laboratory for use in the same way. A wettable powder containing 32 per cent. diazinon [O,O-diethyl O-2-isopropyl-4-methyl-6-pyrimidinyl phosphorothioate] was the most promising, and caused a quicker knockdown of beetles exposed to sawdust mixed with it and had a longer residual effect than the standard BHC powder, but was more expensive. The use of the BHC powder for the treatment of sawdust as it is carted away from the bench in sawmills was introduced in February 1956, and a considerable reduction in breeding in the heaps resulted. In one sawmill, beetles and larvae were seen beneath the benches, and BHC is therefore now applied to such areas also.

Coconut Pests and Diseases Board. Report for the Period 1st June, 1955 to 31st May, 1956.—*Coun. Pap. Fiji* 1956 no. 34, 9 pp., 1 fldg. map, 1 fldg. graph. Suva, 1956. **1st June, 1956 to 31st May, 1957.**—*Op. cit.* 1957 no. 34, 10 pp., 1 fldg. map, 1 fldg. graph. 1957.

Each of these reports contains a section on the distribution and incidence of *Oryctes rhinoceros* (L.) on coconut in Viti Levu, Fiji [*cf. R.A.E.*, A **44** 419, etc.], and a map showing the extent of its spread during the year under review. The beetle is present mainly in coastal districts in the south-east of the island. By 31st May 1955, it occurred as far west as Namboutini, on the south coast, and as far north as Dakuinuku, on the east coast; a year later, it had spread ten miles further north along the east coast to Dawasamu. The main breeding area on the south coast was associated with sawmills and the accompanying sawdust. By 31st May 1957, the beetle had spread about ten miles further along the south coast and about 15 miles further along the north-east coast, but the main centres of breeding were still in the extreme south-east. The results of extensive collections of various stages and the control measures in use are reviewed in both reports; the latter consisted principally in the destruction or treatment of breeding places, including the treatment of sawdust at mills with BHC [*cf.* preceding abstract], and the treatment of the crowns of palms with BHC in damp sawdust [*cf.* **44** 419]; the use of treated compost traps was discontinued.

Introduced natural enemies of *O. rhinoceros* liberated comprised predacious Coleoptera of the genera *Hololepta* (*Leionota*) and *Pyrophorus*, in the first year, and adults of *Scolia oryctophaga* Coq., received from Madagascar, and a nematode of the genus *Rhabditis*, near *R. maupasi*, from Ceylon, in the second. The nematode, which infests and kills larvae and adults of *O. rhinoceros* in Ceylon, was reared in the laboratory in Fiji and found to infest other Lamellicorn larvae also. Colonies of it were despatched to Samoa.

Each report contains an appendix by H. W. Simmonds. That to the first report includes a survey of the local predators of *O. rhinoceros* in Fiji. The larvae are destroyed by various insects in decaying wood and compost heaps, though none is of much practical importance, but no predators have been observed in sawdust, the other common breeding medium. Introductions of further predators are desirable, and several that appear suitable are suggested. It is further stated that *Scolia ruficornis* F., which was introduced into Western Samoa from Zanzibar in 1955 for liberation against *O. rhinoceros* [*cf.* **38** 49], was found in 1952 to be widely but thinly distributed over a considerable area there, and on a visit in 1956 to have increased greatly in numbers. In the appendix to the second report, it is pointed out that this parasite has been hindered in Samoa by some of the methods used for control of the beetle, such as the destruction of a compost heap that was frequented by numerous adults.

BRITTON (E. B.). **A Revision of the Genus** *Dermolepida* **(Coleoptera: Melolonthinae).**—*Proc. R. ent. Soc. Lond.* (B) **26** pt. 3–4 pp. 51–59, 18 figs. London, 1957.

A key is given to the 11 species of *Dermolepida* recognised by the author, followed by descriptions of them and distribution records. Three are described as new, and one of these, *D. noxium*, is stated to be a serious pest of cacao in Papua, the larvae causing the death of 80 per cent. of seedlings one year old. Larvae of a parasite found together with them were identified as *Campsomeris* sp.

VIADO (G. B.), CENDAÑA (S. M.) & RIVERA (C. T.). **Organic Insecticides in the Control of** *Citrus* **Rind Borer.**—*Philipp. Agric.* **40** no. 2 pp. 84–89, 6 refs. College, Laguna, 1956.

Infestation by *Prays endocarpa* Meyr. causes *Citrus* fruits to drop prematurely in the Philippines, and also leads to the formation of unsightly swellings on the rind of mature fruits [*cf. R.A.E.*, A **19** 742]. Three experiments on control by means of sprays were carried out in 1955–56, 5–6 applications being made over periods of several months and infestation recorded at intervals. In the first, the percentages of fruits infested averaged 0·49 for 1 U.S. pint 19·5 per cent. emulsifiable endrin, 1·4 for 0·5 U.S. pint Systox [26·2 per cent. diethyl 2-(ethylthio)ethyl phosphorothioate (demeton)], 4·38 for 2 lb. 2 per cent. wettable parathion, 4·49 for 2 lb. 25 per cent. wettable DDT, 5·12 for a combination of DDT and molasses, and 5·96 for 1 lb. 15 per cent. wettable dieldrin per 100 U.S. gals., as compared with over 10 for no treatment. Infestation was higher in fruits picked from the trees than in those collected from the ground. In the second, 2 lb. 25 per cent. wettable EPN [O-ethyl O-p-nitrophenyl phenylphosphonothioate] per 100 U.S. gals. was as effective as the endrin spray and other materials less effective, and in the third, EPN, endrin and Systox all gave significant control with no significant difference between them. The DDT, parathion and dieldrin sprays resulted in an increase in injury by mites in the first test, but there were indications that EPN, Systox and endrin caused a reduction in it.

VIADO (G. B.), ORILLO (F. T.), BASIO (D. G.) & VALDEZ (R. B.). **Six Combination Sprays in the Control of Insect Pests and Diseases of Cacao.**—*Philipp. Agric.* **40** no. 3 pp. 129–134, 7 refs. College, Laguna, 1956.

In tests of combined sprays for the control of insects and fungi attacking cacao in the Philippines in 1955–56, DDT was used at 2 U.S. quarts 25 per cent. emulsion concentrate, dieldrin at 1 lb. 50 per cent. wettable powder, EPN [O-ethyl O-p-nitrophenyl phenylphosphonothioate] at 2 lb. 25 per cent. wettable powder and toxaphene at 4 lb. 40 per cent. wettable powder per 100 U.S. gals. in combination with Dithane Z-78 [65 per cent. zineb (zinc ethylenebisdithiocarbamate)] at 2 lb., and dieldrin also with Orthocide 50 [50 per cent. N-(trichloromethylthio)-4-cyclohexene-1,2-dicarboximide (captan)] at 2 lb. or bordeaux mixture. Applications were made fortnightly from 17th June, when the trees were beginning to flower, until 9th December, when the smallest pods were about an inch in diameter. The only insects causing serious damage to the pods were *Helopeltis bakeri* Popp. and *Pachyrhynchus moniliferus* Germ., though *Acrocercops cramerella* (Sn.) and an unidentified species of *Helopeltis* (probably *H. collaris* Stål) were also present in small numbers. All the insecticides except toxaphene gave significant control of *P. moniliferus*, and all controlled *Helopeltis* spp., the best combinations being dieldrin with bordeaux mixture against the former and EPN with zineb against the latter. All appeared to be effective against *A. cramerella*. Fungi were satisfactorily controlled, and there was no spray damage to the trees except a slight scorching of the leaves by dieldrin with zineb.

YADAO (A. I.). **Tests of five insecticidal Sprays in the Control of Insects affecting Tobacco.**—*Philipp. Agric.* **40** no. 4 pp. 185–194, 10 refs. College, Laguna, 1956.

Experiments were carried out in the Philippines in 1955–56 on the efficacy of sprays in controlling insect pests of tobacco. In field tests, the insects found attacking the plants were *Heliothis armigera* (Hb.), *Prodenia litura* (F.), *Phaneroptera furcifera* Stål, *Plusia chalcites* (Esp.), *Cyrtopeltis* (*Engytatus*) *tenuis* Reut. and *Oecanthus indicus* Sauss., all of which fed on the leaves or buds, though *Oecanthus* was rare. The insecticides comprised an emulsion concentrate containing 46·7 per cent. parathion and one containing 20 per cent. lindane [almost pure γ BHC] both used at 4·7 ml. per U.S. gal., one containing 19·5 per cent. endrin, for which the dilution is not specified, one containing 25 per cent. DDT, used at 19 ml. per U.S. gal., and a wettable powder containing 69 per cent. calcium arsenate, at 13·7 g. per U.S. gal. Spraying was begun 15 days after transplanting, and 16 weekly or eight fortnightly applications were made. Only calcium arsenate caused any plant injury. Determination of the percentages of leaves undamaged showed that all treatments except γ BHC applied fortnightly gave highly significant increases. DDT applied weekly gave the best results, the mean percentage increasing from 18·32 to 91·25. The populations of Lepidopterous larvae were highly significantly reduced by all the insecticides, but γ BHC (the least effective) was much inferior to DDT (the best), which gave almost complete control. There were no differences due to number of applications. None of the treatments had much effect on *Phaneroptera*, and only DDT significantly reduced the population of *Cyrtopeltis*.

In laboratory tests, adults of *P. furcifera* and larvae of *Prodenia litura* were confined on sprayed tobacco leaves, and mortality was estimated 3–72 hours later. Parathion was used as before, the DDT concentrate at 41·7 and the endrin and γ BHC concentrates at 18·42 ml. per U.S. gal., and the calcium arsenate at 29 g. per U.S. gal. All materials gave significant mortality of both insects in 12 hours except calcium arsenate, which was rather ineffective; parathion was the best, giving complete kill of *Phaneroptera* and 80 per cent. kill of *Prodenia*.

Hacskaylo (J.) & Ergle (D. R.). **Compositional and physiological Responses of the Cotton Plant to the Systemic Insecticides Schradan and Demeton.**—*Bull. Tex. agric. Exp. Sta.* no. 821, 18 pp., 7 figs., 41 refs. College Station, Tex., 1955.

The following is substantially the authors' summary. Cotton plants grown in culture solution containing schradan accumulated the insecticide in successively lower concentrations in the leaves, roots, bolls, petioles and stems. Relatively low concentrations of schradan stimulated vegetative development, but higher concentrations (100 and 1,000 parts per million of the solution) reduced both vegetative and fruiting activity.

Increased concentrations of chlorophyll and carotenoid pigments were directly correlated with schradan treatment. It is suggested that this additional photosynthetic potential was related to the increases in plant dry weights that occurred with the non-phytotoxic concentrations. As the nitrogen level in the nutrient solution was decreased, schradan was found to accumulate in the plant in significantly larger quantities. A similar but weaker trend was noted when the phosphorus concentration was varied, but the level of external potassium had little or no effect on schradan absorption. Plants grown in phosphorus-deficient solutions made significantly greater growth with than without added schradan in non-phytotoxic concentrations. Marginal scorching of the leaves occurred on the plants deficient in phosphorus but not on those receiving schradan.

Neither schradan nor demeton [diethyl 2-(ethylthio)ethyl phosphorothioate], when applied to cotton as a foliar spray or when the former was absorbed by the roots, affected the viability of the seed produced. The schradan-treated plants produced seed that tended to be higher in protein and lower in oil content than the untreated plants, while the demeton-treated plants produced seed that was higher in oil and lower in protein content. There was no effect on phosphorus accumulation. Young bolls contained only 1 per cent. of the total schradan accumulated by the cotton plant, and there was no evidence of increased accumulation through the addition of boron and sucrose to the solution. Seed embryos from plants grown continuously on solutions containing schradan contained 1–10 p.p.m. of the insecticide. Attempts to determine the demeton in treated cotton plants by inhibition of cholinesterase *in vitro* were not successful, owing to the presence of a natural inhibitor in the boll, possibly gossypol. The ability of schradan to inhibit cholinesterase was increased 5–12 times by passage through the plant.

Soluble nitrogen in the plant increased as the schradan concentration in the nutrient solution was increased, but there was no effect on the protein fraction. At the highest level of insecticide used, there was a slight increase in phosphorus and a highly significant reduction in total sugars. The effect of schradan on starch, which was increased substantially by the two higher concentrations, appeared limited to the root tissues.

Fowler (H. D.). **Some physiological Effects of Attack by Whitefly** (*Bemisia gossypiperda*) **and of spraying Parathion on Cotton in the Sudan Gezira.**—*Emp. Cott. Gr. Rev.* **33** no. 4 pp. 288–299, 1 fig., 36 refs. London, 1956.

Bemisia tabaci (Gennadius) (*gossypiperda* Misra & Lamba) has in the past few years increased in importance as a pest of cotton in the Sudan [*cf.* *R.A.E.*, A **44** 149]. The author reviews from the literature the effects of infestation by this Aleyrodid and of the application of parathion or related compounds to plants, and describes a small-scale experiment carried out in the Sudan Gezira in 1952–53 to determine, in addition to the effect of the insecticide on the Aleyrodid, the effects of both factors on the contents of nitrogen, acid-soluble phosphorus and sugar in the leaves. Infestation was of medium intensity. Sprays of 0·25, 0·5 or 1 lb. 20 per cent. parathion in 96 gals. per acre were applied on 12th October and 4th November, and samples of sprayed leaves and of lightly and heavily infested unsprayed leaves were taken on 25th October and 10th and 30th November and analysed. The data were compared with those obtained before spraying, and the following is based on the author's summary of the results.

The nitrogen content of the untreated leaves was higher in lightly than in heavily infested cotton until 25th October (65 days from sowing), but lower in the lightly infested leaves on the two later dates [*cf.* **32** 27]. The sugar content did not differ significantly in the lightly and heavily infested leaves; it was reduced by an average of 23 per cent. in the samples taken between 11th October and 10th November, but had risen again by 30th November, when infestation had declined, and it is thought that the loss of sugar resulting in a year of heavy attack might cause poor lint development. There was a significant negative correlation between the contents of sugar and acid-soluble phosphorus. Spraying tended to increase the nitrogen and phosphorus contents of the leaves and to reduce the sugar content, but the differences approached significance only in the case of nitrogen. These changes tended to increase the vegetative growth of the plants, and it is concluded that, once the balance of nitrogen and carbohydrates has been restored, the apparently direct effects of the spray might be expected to counteract the loss of nutrients caused by the pest and give rise to an increased later crop. It is added, however, that no visible increase in vegetative growth was observed in subsequent seasons as a result of treatment [*cf.* **45** 232–233].

GOODMAN (A.). **The Tokar Investigation.**—*Emp. Cott. Gr. Rev.* **33** no. 4 pp.300–306, 13 refs. London, 1956.

Cotton has long been grown at Tokar, on the Red Sea coast of the Sudan, but yields are poor, owing to unsuitable climatic and other conditions. *Heliothis armigera* (Hb.) and *Creontiades pallidus* (Ramb.) were observed on the crop in 1946, and investigations were begun in 1948 to ascertain whether control of them by DDT sprays would improve the yield. The results showed that infestation by these insects delays the crop by 2–3 weeks but does not result in the destruction of more fruiting bodies than would be lost in their absence as a result of physiological shedding. Spraying therefore has no effect on the yield, although it controls the insects.

PHELPS (R. J.). **Investigation on the Biology of** *Piezotrachelus varium* **(Wagner) and** *Apion* **(***Conapion***)** *chirindanum* **Wagner (Coleoptera: Apioninae).**—*J. ent. Soc. S. Afr.* **19** no. 1 pp. 86–99, 9 figs., 11 refs. Pretoria, 1956. **A Contribution to the Morphology of** *Piezotrachelus varium* **(Wagner): (Coleoptera, Apioninae) with Observations on that of** *Apion* **(***Conapion***)** *chirindanum* **Wagner (Coleoptera: Apioninae).**—*T. c.* pp. 143–191, 29 figs., 33 refs.

Seed crops of cowpeas of the upright and decumbent types in Natal are seriously reduced by *Apion* (*Piezotrachelus*) *varium* Wagn. and *A. chirindanum* Wagn., and an account of investigations during 1953–55 on the bionomics of these weevils is given in the first of these papers.

In the field, *A. varium*, all stages of which are briefly described and which is the more important, bred only on cowpea, and females caged with other leguminous plants did not oviposit on them. The adults were present throughout the year and injured the foliage of numerous plants; the number that survived the winter depended on its severity. On cowpea, adult feeding was confined to the upper epidermis and mesophyll of the leaves and provided a means of entry for pathogenic organisms but did not affect the growth of the plants. When the pods appeared, the weevils congregated on the plants, and the population increased until the pods matured, and then declined, with a marked drop after the first frost; when there were no more green leaves, the adults entered the litter beneath the plants. The pre-oviposition and oviposition periods lasted 16–21 and 21 days, respectively, and the eggs were laid in batches of about 15 in succulent pods 2–3 ins. long; females offered freshly picked green pods or dry seeds did not oviposit on them. Most eggs were deposited on the funicle of the seed, but some were laid on the septum of the pod and some, late in the season, in the seed. Eggs were present in the pods from early March to the end of May. The larvae each consumed several seeds, often completely, and appeared to pass through four instars, in the last two of which they did not feed; they pupated in the pod, and the pupae were susceptible to attack by a disease organism. Up to 15 per cent. of the seeds were damaged, and the percentage of pods infested ranged from 29 to 100. In the laboratory, the durations of the egg, larval and pupal stages averaged 6·4, 20·2 and 7·3 days at 20°C. [68°F.] and 2·7, 9·7 and 3·1 days at 30°C. [86°F.]; relative humidity had little effect. In the field, complete development lasted 24–32 days.

A. chirindanum, which is not abundant, bred only in the flower buds of cowpea, though the adults were observed on the foliage of ornamental plants. The larvae fed and pupated singly in the buds, and there was little variation in numbers during the growing season. Both species were attacked by unidentified parasites.

In the second paper, descriptions are given of all stages and the reproductive organs of both sexes of *A. varium*, together with characters differentiating *A. varium* and *A. chirindanum* and notes on the modified Malphigian tubules containing microscopic organisms of unknown status that occur in both species.

KERRICH (G. J.). **A systematic Study of the Parasite Complex of the Karroo Caterpillar, *Loxostege frustalis* Zeller: Perilampidae and Ichneumonidae (Hym.).**—*J. ent. Soc. S. Afr.* **19** no. 1 pp. 118–127, 8 figs., 13 refs. Pretoria, 1956.

NIXON (G. E. J.). **Two new Braconid Parasites of *Loxostege frustalis* Zell. in South Africa.**—*T. c.* pp. 128–131, 5 figs., 2 refs.

The second of these two papers on the complex of parasites associated with *Loxostege frustalis* (Zell.) in South Africa [*cf.* also *R.A.E.*, A **45** 469] contains descriptions of the adults of two new Braconids reared from this Pyralid and designated *Macrocentrus maraisi* and *Cremnops frustalis*. The first paper contains taxonomic information on three Perilampids and two Ichneumonids that belong to the complex. Two hyperparasites are described as new. One of them is *Perilampus rostratus*, which was reared from *M. maraisi* and may also attack other primary parasites of *L. frustalis*, and the other is *Mesochorus breviscapus*, the primary hosts of which are possibly Tachinids.

DESCAMPS (M.). **Deux diptères nuisibles au riz dans le Nord Cameroun *Pachydiplosis oryzae* Wood Mason *Pachylophus* sp. aff. *lugens* Loew.**—*Phytiat.-Phytopharm.* **5** no. 2 pp. 109–116, 1 fig., 4 refs. Paris, 1956.

The principal Dipterous stem-borers of rice in the north of the French Cameroons other than Diopsids [*cf.* *R.A.E.*, A **46** 29] are *Pachydiplosis* *oryzae* (Wood-Mason) and a species of *Pachylophus* near *P. lugens* Lw. Brief descriptions are given of all stages of the first and of all but the egg of the second, and observations on their bionomics and natural control are recorded. *Pachydiplosis* is the most important pest of rice, particularly in the Logone valley, and destroyed 75 per cent. of the stems in 1954. The eggs of this Cecidomyiid are laid in small groups, and the larvae feed singly in the stems, causing the formation of bulbous swellings above the root-collar [*cf.* **30** 612] and the death of the infested parts. Numerous tillers appear and are in their turn infested. Pupation occurs in the stems, the adults emerging about a week later. Infestation begins a few weeks after the rice has germinated, usually at the end of July, and increases until October, when the rice-fields begin to dry up. In August, at the height of the rains, the life-cycle lasts about 25 days. After the harvest, the Cecidomyiid infests wild rice (*Oryza barthi*), which grows abundantly in and near water in the valley, and as this dries up, the larvae enter diapause. Almost all have done so by February, but development may continue throughout the dry season under favourable moisture conditions. It is normally resumed at the beginning of the rains. The larvae are parasitised by *Tetrastichus pachydiplosisae* Risbec [*cf.* **46** 30] on cultivated rice, parasitism reaching 20 per cent. in August–September, and by *Platygaster diplosisae* Risbec on wild rice. The latter destroyed 38 per cent. of the active larvae and 50–60 per cent. of those entering diapause in December–March. Larvae in diapause were also parasitised by *Anisopteromalus* (*Aplastomorpha*) *camerunus* (Risbec), and a species of *Bracon* near *B. annulicornis* (Brues) and *Neanastatus tenuis* var. *platygasteri* Risbec were obtained from the pupae.

The larvae of *Pachylophus* sp. enter the stems near the ligules just above the root-collar and bore downwards through the heart leaves. Infestation is commonest in young stems, but also occurs in old ones, particularly at the end of the season. The stems do not break off until the larvae of the Chloropid have completed their development, which lasts 15–20 days during the rainy season. Pupation takes place at the base of the stems, and the pupal stage lasts 12–14 days in August–September. Reproduction continues throughout the year, young shoots in rice-fields and wild grasses, including *O. barthi*, being attacked after harvest. The larvae and pupae were parasitised by *Aprostocetus* (*Tetrastichus*) *diopsisi* Risbec, and the pupae by *A.* (*T.*) *pachylophusae* (Risbec), *Melittobia diopsisaephila* Risbec, and *Tetrastichus* (*Epomphaloides*) *dipterae* (Risbec).

de Luca (Y.). **Contributions à l'étude morphologique et biologique de** *Bruchus lentis* **Fröhl. Essais de lutte.**—*Ann. Inst. agric. Algér.* **10** fasc. 1 pp. 1–94, 75 figs., 44 refs. Algiers, 1956.

The cultivation of lentils has increased greatly in Algeria of recent years, but the value of the harvested crop is much reduced owing to heavy infestation by *Bruchus lentis* Froel. The conditions under which the lentils are grown and all stages of the Bruchid are described, and an account is given of observations on the bionomics and control of the beetle begun in 1952. These showed that complete development lasts about 54 days. Oviposition begins in April–May, soon after the appearance of the first pods, reaches its maximum rapidly, and continues for some 25 days. The eggs are laid on the pods, or on exposed seeds in them in older ones, which seem to be preferred, and hatch in 10–15 days, according to temperature. The larvae enter the seeds, hollow them out by feeding, and later pupate in them, after a development period of about six weeks. The pupal stage lasts 6–7 days, and the adults leave the seeds after a period ranging from 48 hours to several months. They overwinter in unknown sites, and do not pair until spring. Only one individual completes its development per seed, and the percentage infestation averages about 10. A few larvae were parasitised by *Triaspis* (*Sigalphus*) *thoracicus* (Curt.) and *Bruchobius laticeps* Ashm., both of which were themselves attacked by *Eupelmella vesicularis* (Retz.).

Methods of controlling *B. lentis* are discussed at some length [*cf. R.A.E.*, A **42** 116]. Preventive measures consist largely in clean harvesting, early threshing of the crop, and the sowing of uninfested seed, but late sowing (in February) prevents much of the infestation. Treatment by fumigation kills Bruchids in the seeds but does not improve the quality of the latter, and the removal of damaged seeds is impracticable. In the laboratory, deposits of 0·025 per cent. parathion on glass gave complete mortality of adults in 24 hours, and similar results were obtained in the field from a spray applied when the Bruchid was about to oviposit. A parathion dust was slightly less effective, but either treatment remains effective for about ten days, so that one application at the beginning of oviposition would probably kill most of the egg-laying females. A dust of methyl-parathion applied to freshly laid eggs in the laboratory prevented hatching, though not embryonic development, but was less effective against older eggs in the field, some larvae hatching and entering the seeds normally.

FERNANDO (H. E.). **Pineapple and Cacao Mealy-bugs of economic Importance in Ceylon.**—*Trop. Agriculturist* **112** no. 2 pp. 132–141, 3 figs., 14 refs. Peradeniya, 1956.

CARTER (Walter). **Notes on some Mealy-bugs (Coccidae) of economic Importance in Ceylon.**—*T. c.* pp. 142–145, 4 refs.

The first of these papers was written to provide a background for the second, which has already been noticed from another source [*R.A.E.*, A **44** 246], and to amplify some of the findings reported in it with regard to mealybugs on pineapple and cacao in Ceylon.

Dysmicoccus (*Pseudococcus*) *brevipes* (Ckll.) causes pineapple wilt, the successive stages of which are described, and recovery of affected plants is rare in Ceylon. Limited experiments indicated that symptoms on pineapple plants six months old appeared about 65 days after feeding by the mealybug. Both a bisexual strain of *D. brevipes* and a parthenogenetic one are present. The former, which causes green spotting of the leaves, occurs in the western province and the latter in the Bibile area. The mealybug is apparently favoured by the use of coconut-fibre dust as a mulch for weed control, and is tended by several species of ants. Suckers for planting were freed from infestation by dipping in emulsions containing 0·05 per cent. malathion, 0·025 per cent. diazinon [O,O-diethyl O-2-isopropyl-4-methyl-6-pyrimidinyl phosphorothioate] or 0·01 per cent. parathion and stacking for 24 hours in an erect position, so that the insecticide accumulated at the leaf bases, where the mealybugs congregate. BHC and DDT were much less effective. The phosphorus insecticides at the same concentrations also controlled the mealybug on growing plants in the field when applied as sprays at 250 gals. per acre, care being taken to clear the leaf bases from débris and to ensure that the spray accumulated at them.

The three mealybugs that occur on cacao [*cf. loc. cit.*] are all attended by ants, but are controlled to some extent by the predacious larvae of the Lycaenid, *Spalgis epius* (Westw.), and the Coccinellid, *Exochomus melanocephalus* (Zoubkoff) (*nigromaculatus* (Goeze)). In view of Carter's failure to obtain transmission of the swollen-shoot virus in Ceylon by *Ferrisiana* (*Ferrisia*) *virgata* (Ckll.) [*cf. loc. cit.*], which transmits it in Ghana [*cf.* **39** 47], intensive transmission tests with this species were continued, but no positive results were obtained. *Planococcus* (*Pseudococcus*) *lilacinus* (Ckll.), *P.* (*P.*) *citri* (Risso) and *F. virgata* did not transmit the virus from cacao to dadap (*Erythrina lithosperma*), which is commonly grown for shade on cacao plantations, and did not cause the appearance of any symptoms on cacao to which they were transferred from dadap leaves showing vein-flecking. The cacao virus present in Ceylon is a mild strain, and no attempt is being made to restrict its spread.

Symposium on Shot Hole Borer.—*Tea Quart.* **27** pt. 4 pp. 83–143. Talawakelle, 1956.

A symposium to consider all aspects of the problem of the shot-hole borer, *Xyleborus fornicatus* Eichh., on tea was held in Ceylon on 14th September 1956, and the texts of the various addresses presented and the discussion that followed are here reproduced. In addition to reports from various planters' associations, they included a general review of the problem created by the Scolytid in Ceylon, by G. B. PORTSMOUTH (pp. 92–96), a historical review of investigations on the insect and its control there, by G. D. AUSTIN (pp. 97–102), and an account of research carried out from October 1955 to August 1956, by E. JUDENKO (pp. 103–105). Judenko states that in view of some disagreement as to the identity of the beetle, nearly 3,000 examples collected from pruned tea branches in various districts of Ceylon were submitted to Schedl, who identified all but two as *X. fornicatus* [*cf. R.A.E.*, A **36** 251]. Field and laboratory observations showed that the females are able to fly to a height of 5 ft. The ratio of males to females is at least 1:3, and this, together with the fact that the males can neither fly nor make galleries, suggests that the females reproduce parthenogenetically. Beetles kept in a container with water lived for up to 16 days, with an average of 4 days, whereas those kept simultaneously without water were all dead in a day [*cf.* **37** 137], living beetles were found in prunings dissected after immersion for about a day in water. Emergence from prunings was more rapid under dry than under wet conditions. Mortality soon after emergence was also higher, and preliminary experiments suggested that the ability to infest tea is also greater under wet than under dry conditions. The degree of infestation was best assessed [*cf.* **40** 358] as the number of galleries per 100 pieces of living branch 4 ins. long, $\frac{3}{8}$ inch in diameter and free from secondary branches or shoots. When this was done, 35 and 46 galleries per 100 units were found in two fields that were not considered to be suffering damage, as compared with 123, 148 and 186 in three that were.

Other contributions included one by T. E. WALTER (pp. 107–111, 1 fldg. graph), in which the effect of the length of the pruning cycle on infestation in the low-country of Ceylon is discussed and a short cycle of 18 months is considered the most suitable as regards yield, one by R. L. ILLANKOON (pp. 112–113), on *X. fornicatus* in small holdings, in which it is stated that the beetle is a pest in those at elevations of 1,500–3,000 ft. and almost non-existent at very low and very high altitudes, that healthy bushes are more susceptible to attack than poor ones, that branch breakage is the chief damage caused, and that lengthening the pruning cycle to three years is effective in reducing injury, one by B. N. WEBSTER & T. VISSER (pp. 114–119, 5 figs.), in which the physiological and pathological effects of infestation by *X. fornicatus* [*cf.* **39** 64] are described, one by J. A. H. TOLHURST (pp. 120–122), in which the possible relation of manuring to infestation is discussed, and one by S. ANANDA RAU (pp. 123–124), in which it is pointed out that *X. fornicatus* also occurs on tea in certain localities in southern India [*cf.* **36** 251], but causes little damage and shows no tendency to spread [*cf.* **30** 337; **32** 433].

Das (G. M.). **Psychidae (Lepidoptera) on Tea in north-east India.**—*Ann. Mag. nat. Hist.* (12) **9** no. 104 pp. 569–576, 1 pl., 3 refs. London, 1956.

In view of confusion as to the identity of some of the Psychids that injure tea in north-eastern India, the author gives a list of those known, with notes on the morphology of the adults and larval cases and on the habits and local distribution of as many as possible. In addition to two that have not been identified, they are *Clania cramerii* (Westw.), *C. destructor* (Dudg.), *C. sikkima* (Moore), *C. antrami* Hmps., *C. mahanti* Das, *C. vaulogeri* Heyl., *Mahasena theivora* (Dudg.), *Amatissa consorta* (Templ.), *Metisa plana* Wlk., *Brachycyttarus subtalbatus* Hmps., *Pteroma plagiophleps* Hmps., *Oiketicoides bipars* (Wlk.), *Manatha assamica* (Watt), *Cathopsyche reidi* (Watt), *Chalioides ferevitrea* Joann., *C. vitrea* Hmps. and *Dappula tertia* (Templ.). All feed on the leaves, and some also on the bark.

Leston (D.) & Scudder (G. G. E.). **The Taxonomy of the Bronze Orange-bug and related Australian Oncomerinae (Hemiptera: Tessaratomidae).**—*Ann. Mag. nat. Hist.* (12) **10** no. 114 pp. 439–448, 15 figs., 6 refs. London, 1957.

As a result of the discovery of the type material of *Rhoecocoris australasiae* (Westw.), *Rhoecocoris* is restricted to *R. australasiae* (its type species) and redescribed, and *Musgraveia*, gen. n., is erected for *R. sulciventris* (Stål) (the type) and one other species, and described. *M. sulciventris* (the bronze orange-bug) is a pest of *Citrus* in Australia [*cf. R.A.E.*, A **36** 108, etc.]. A check-list of the Australian genera and species of the group is given, together with a key to the genera and notes on most of them.

Southgate (B. J.) & Pope (R. D.). **The Groundnut Seedbeetle, a Study of its Identity and taxonomic Position.**—*Ann. Mag. nat. Hist.* (12) **10** (1957) no. 117 pp. 669–672, 2 pls., 14 refs. London, 1958.

Stored groundnuts in various parts of the world are commonly infested by a Bruchid of the genus *Caryedon*, the original home of which is uncertain but which has long been established in Africa and India, breeding in *Acacia* spp., *Tamarindus indica*, and related leguminous plants. It has usually been identified as *C.* (*Caryoborus* or *Pachymerus*) *gonagra* (F.) [*cf. R.A.E.*, A **29** 523; **30** 13; **31** 42], *C.* (*Caryoborus* or *Pachymerus*) *fuscus* (Goeze) [**45** 492], *Pachymerus cassiae* (Gylh.) [**45** 492] or *P. acaciae* (Gylh.) [**25** 96]. One or both authors have examined the only authentic specimen of *C. fuscus*, which is in the Geoffroy collection in Paris, the type specimens of *C. gonagra*, *C.* (*P.*) *cassiae* and *C.* (*P.*) *acaciae*, and examples from groundnuts in various parts of the world, and they conclude that *C. gonagra* is responsible for all or almost all the groundnut infestations reported. *C. fuscus* is closely related to *C. cassiae*, which is variable, and its true status will not be known until dissection of the Geoffroy specimen is permitted. *C. gonagra* has been misidentified on groundnuts in Nigeria as *C.* (*P.*) *longus* (Pic) [*cf.* **33** 370], which is, in the authors' experience, confined to southern Africa. The adults of both sexes of *C. gonagra* are described, and the genitalia of the male are illustrated.

Burgess (A. H.). **Hop Growing and Drying.**—*Bull. Minist. Agric.* no. 164, vi + 62 pp., 16 pls., 10 figs., 34 refs. London, H.M.S.O., 1956. Price 5*s.* 0*d.*

This bulletin on the cultivation of hops in England includes a section by B. D. Moreton (pp. 51–60) in which information is given on the importance, bionomics and control of the insects and a few other invertebrate pests that attack the plants, and one on diseases, by H. H. Glasscock (pp. 41–51), including virus diseases that are transmitted by insects.

Darling (H. S.) & Derbyshire (D. M.). **Systemic Insecticides and Control of the Hop Aphis.**—*Rep. Dep. Hop Res. Wye 1955* pp. 43–47. Wye, 1956.

Figures are given showing that the change made in 1953 from sprays of nicotine and TEPP [tetraethyl pyrophosphate] to a schedule of 2–3 high-volume sprays of 0·05 per cent. schradan, followed by one of 0·025 per cent. TEPP, for the control of *Phorodon humuli* (Schr.) on hops in Kent [*cf. R.A.E.*, A **44** 345] has resulted in an increase in the number of bushels of green hops required to give 1 cwt. dried hops.

In 1955, the first alates of *P. humuli* migrated to the crop in early June, and the main invasion began in the middle of the month. Sprays of schradan on 6th and 23rd June and 23rd July and one of TEPP on 12th August did not give complete control, but permitted the production of a crop of good quality. Light infestations developed in the ripening cones in September, originating almost certainly from the small colonies that persisted on the leaves throughout the summer, and it appeared that some of the Aphids might be tolerant of the insecticides at the strengths used and that strains resistant to organic phosphorus compounds may exist. Populations increased rapidly on unsprayed plants, and every leaf was infested by mid-July, but treatment with schradan on 16th July gave good control and permitted the plants to produce a satisfactory crop.

In tests of schradan applied to the soil, doses of 1, 1·5 or 2 g. in 4 fl. oz. water per hill were applied once, on 27th June. The compound did not exert its full effect for about four weeks, but then appeared to give control for the rest of the season. The lowest dose was as effective as the standard schradan sprays, and the others were substantially better. Dimefox (bis(dimethylamino) fluorophosphine oxide) was applied to the soil once in the first half of June at the rate of 0·1, 0·3 or 0·5 g. per hill in 4 fl. oz. water or in pellets. The liquid formulations seemed slightly the more effective at each dosage; their insecticidal action began on the day after application, reached its maximum effectiveness in 3–5 days, and was then maintained for 5–6 weeks, whereas the pellets showed only slight activity after five days and did not become fully effective for 3–4 weeks, but then afforded maximum control until the hops were harvested, three months later. The lowest dose gave as good control as the standard schradan sprays, though the liquid treatment permitted higher Aphid populations in August. The two higher doses were substantially better than the standard treatment; the liquids almost eliminated the Aphids for up to a month, and all formulations kept the percentage of leaves infested during July and August to a low level. However, small Aphid populations persisted and were probably responsible for the infestation of the cones that occurred in September. They did not appear to be much affected by a TEPP spray applied in mid-August and may have belonged to a resistant strain. Hops picked three months after treatment with dimefox and dried showed residues of 0·1–0·2 and 0·3 parts per million after liquid and pellet treatments, respectively, irrespective of the doses applied. Treatment of the soil with about 0·15 g. dimefox in 2·5 fl. oz. water per plant to control Aphids in the propagation rows was very successful on cuttings of one variety but injured an appreciable proportion of young plants of unnamed breeding material.

The application of high-volume sprays of 0·038 per cent. methyl-demeton (dimethyl 2-(ethylthio)ethyl phosphorothioate) on 23rd June and 14th July gave very good control of *P. humuli* and appeared to be superior to treatment with dimefox or schradan. No late-stage nymphs or apterae were observed on the plants after the first application, and no attack developed on the cones. When applied to the soil at 0·14 or 0·28 g. per hill in 4 fl. oz. water on 13th June, methyl-demeton was ineffective, giving less control than the standard schradan sprays.

KOTTE (W.). **Krankheiten und Schädlinge im Obstbau und ihre Bekämpfung.** [Diseases and Pests in Fruit Growing and their Control.]—3rd revd. edn., 9¼ × 6¼ ins., xvi + 519 pp., 8 col. pls., 233 figs., 18½ pp. refs. Berlin, P. Parey, 1958. Price *DM.* 54.

This is a revised and expanded edition of a book previously noticed on the pests and diseases of fruit crops and their control in Germany [*R.A.E.*, A **37** 275]. The arrangement of the matter is the same, but the information has been brought up to date, especially as relates to control by chemical and biological means, and increased attention is given to virus diseases, some of which are transmitted by insects. The identification tables have been replaced by an extended bibliography.

QUINTANA (F. J.). *Pulvinaria mesembryanthemi* **(Vallot) (Homoptera Stern.). Nueva cochinilla para la fauna argentina y sus zooparásitos.** [*P. mesembryanthemi*, a Coccid new to Argentina, and its Parasites.]—*Rev. Fac. Agron. La Plata* **32** pt. 1 pp. 75–110, 20 figs., 26 refs. La Plata, 1956. (With a Summary in English.)

Pulvinaria mesembryanthemi (Vall.) was found for the first time in Argentina in 1952–56, infesting *Mesembryanthemum edule*, which is grown for soil consolidation and as an ornamental plant, in the Province of Buenos Aires; it also infested *M. cordifolium*. The author reviews the characters of the genus, gives lists of the species found in Argentina, Uruguay and Brazil, and describes all stages of *P. mesembryanthemi*. Observations on the bionomics of the latter showed that it has three generations a year, the adults appearing about August–September, January–February and February–March, and winter being passed by the second-instar nymphs. The parasites of *P. mesembryanthemi* are reviewed; those obtained in Argentina were mainly *Aphycus luteolus* Timb., *Coccophagus caridei* (Brèth.), *C. scutellaris* (Dalm.) and *Tetrastichus* sp. For control, infested plants should be burned during the winter, or a spray of DDT or γ BHC in summer oil emulsion applied twice, at the beginning of hatching and 15–20 days later, at the concentration recommended by the manufacturers.

PAPERS NOTICED BY TITLE ONLY.

McKINLAY (K. S.). **Cotton Pests in the Eastern Province, Tanganyika Territory.**—*Emp. Cott. Gr. Rev.* **33** no. 4 pp. 282–287. London, 1956. [*Cf. R.A.E.*, A **45** 168.]

PETERSON jr. (G. D.). **An annotated Checklist of Parasites and Predators introduced into Guam during the Years 1950–1955.**—*Proc. Hawaii. ent. Soc.* **16** no. 2 pp. 199–202. Honolulu, 1957. **Recent Additions to the List of Insects which attack Crops and other important Plants in Guam.**—*T. c.* pp. 203–207, 10 refs.

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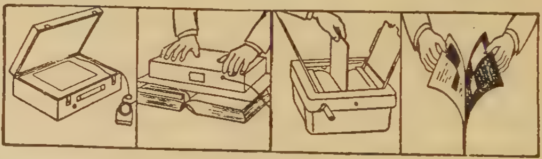

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INDEX OF AUTHORS

ANON., 79, 105, 113.
Albrecht, F. O., 83.
Alfaro Moreno, A., 77.
Allen, H. W., 93.
Ananda Rau, S., 113.
Apple, J. W., 91, 93.
Arbuthnot, K. D., 100.
Arnold, E. W., 93.
Atkins jr., E. L., 95.
Aubin, 77.
Austin, G. D., 113.

Baggiolini, M., 77.
Bann, J. M., 99.
Basio, D. G., 106.
Behura, B. K., 82.
Bibby, F. F., 100.
Boyle. W. W., 103.
Brindley, T. A., 94.
Britton, E. B., 106.
Burgess, A. H., 114.
Buzanov, I. F., 80.

Carter, R. H., 99.
Carter, Walter, 112.
Cartier, J. J., 102.
Cendaña, S. M., 106.
Chrzanowski, J., 80.
Cinq-Mars, L., 85.
Clarke, K. U., 83.
Colyer, C. N., 81.
Cory, E. N., 96.
Cowan jr., C. B., 91.
Cox, H. C., 94.
Crête, R., 85.

Darling, H. S., 115.
Das, G. M., 114.
Daviault, L., 85.
Davich. T. B., 99.
Davis, J. W., 91.
Deal, A. S., 95.
Dean, F. P., 89.
DeCino, T. J., 99.
de Luca, Y., 111.
Derbyshire. D. M., 115.
Descamps, M., 110.
Dunn, P. H., 86.

Earle, N. W., 99.
Ergle, D. R., 108.

Fahey, J. E., 94.
Fernando, H. E., 112.
Forbes, A. R., 98.
Fowler, H. D., 108.
Frost jr., M. H., 95.

Goodman, A., 109.
Gould, E., 101.

Hacskaylo, J., 108.
Hall, I. M., 86.
Hamstead, E. O., 101.
Heie, O., 79.
Hensley, S. D., 100.
Highland, H. A., 96.
Hughes, K. M., 86.
Husson, R., 78.

Illankoon, R. L., 113.

Jeppson, L. R., 95.
Johnson, G. V., 94.
Judenko, E., 113.

Karlin, E. J., 94.
Karpova, A. I., 80.
Kenaga, E. E., 88.
Kerrich, G. J., 110.
King, K. M., 98.
Kotte, W., 116.

Lanchester, H. P., 89.
Laughlin, R., 82.
LeRoux, E. J., 85, 87.
Leston, D., 114.

McKinlay, K. S., 116.
Marcovitch, S., 102.
Mead-Briggs, A. R., 82.
Morrison, H., 77.
Mune, T. L., 104.

Naegele, J. A., 94.
Namba, R., 104.
Nixon, G. E. J., 110.

O'Brien, R. D., 96.
O'Connor, B. A., 104, 105.
Orillo, F. T., 106.

Paradis, R. O., 84, 85.
Parencia jr., C. R., 91.
Parent, B., 85, 87.
Parham, J. W., 104.
Peterson jr., G. D., 103, 116.
Phelps, R. J., 109.
Pope, R. D., 114.
Portsmouth, G. B., 113.
Putman, W. L., 87.

Quintana, F. J., 116.

Racoviţa, A., 80.
Rawlins, W. A., 96.
Renk, A. V., 77.
Reynolds, H. T., 95.
Riehl, L. A., 95.
Rivera, C. T., 106.
Robertson, O. T., 100.

Savary, A., 77.
Scudder, G. G. E., 114.
Smith, O. J., 86.
Southgate, B. J., 114.
Speyer, W., 78.
Srivastava, P. D., 101.
Steiner, L. F., 90.
Stewart, D., 89.
Strong, R. G., 96.
Sun (Yun-pei), 99.

Tolhurst, J. A. H., 113.
Tombes, A. S., 99.
Tomlinson jr., W. E., 103.

Valdez, R. B., 106.
Verdier, M., 83.
Viado, G. B., 106.
Visser, T., 113.

Waede, M., 78.
Walter, E. V., 101.
Walter, T. E., 113.
Webster, B. N., 113.
Wedding, R. T., 95.
Wene, G. P., 92.

Yadao, A. I., 107.
Yust, H. R., 98.

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CONTENTS.

PAGE
Africa: Effects of *Bemisia tabaci* and Parathion on Cotton in Sudan ... 108
Africa: Pest Control not improving Cotton Yields at Tokar, Sudan 109
Africa: Species of *Apion* damaging Cowpeas in Natal 109
Africa: Parasites of *Loxostege frustalis* in South Africa 110
Africa: Dipterous Pests of Rice in French Cameroons 110
Africa: Bionomics and Control of *Bruchus lentis* in Algeria 111
Africa: Pests of Cotton in Tanganyika (*Title only*) 116
Argentina: A first Record of *Pulvinaria mesembryanthemi* 116
Australia: The Nomenclature of the Bronze Orange-bug 114
Britain: Two Phorids damaging Mushrooms 81
Britain: The Bionomics of *Forficula auricularia* 82
Britain: Storage and Utilisation of Reserves by *Anomala horticola* ... 82
Britain: A Bulletin including Notes on Pests of Hops 114
Britain: Systemic Insecticides and *Phorodon humuli* on Hops 115
Canada: Sprays against *Conotrachelus nenuphar* on Apple in Quebec ... 84
Canada: The Effect of Fungicides on Mites on Apple 85
Canada: A Mite attacking *Metatetranychus ulmi* in Quebec 85
Canada: The Bionomics of *Cephalcia marginata* 85
Canada: *Lithocolletis malimalifoliella* infesting Apple 87

[*Continued on p. iv of cover*

CONTENTS—*cont.*

PAGE
CANADA: Differences in Susceptibility of Species of *Chrysopa* to DDT ... 87
CANADA: The Control of *Hylemyia brassicae* attacking Swedes 98
CEYLON: Observations on Mealybugs on Pineapple and Cacao 112
CEYLON: A Symposium on *Xyleborus fornicatus* on Tea 113
DENMARK: The Occurrence of *Myzus ascalonicus* and *M. certus* 79
ECUADOR: The Bionomics of *Pagiocerus fiorii* in stored Maize 98
FRANCE: *Ceratitis capitata* near Paris in 1955 77
GERMANY: *Platypus cylindrus* injuring Oak in the Saarland 78
GERMANY: Parasites of *Ennomos quercinaria* in the Saarland 78
GERMANY: Importance of the natural Enemies of Wheat Gall-midges ... 78
GERMANY: Pests of Fruit and their Control (*Review*) 116
INDIA: The Effect of Insecticides on *Hieroglyphus nigrorepletus* 101
INDIA: The Psychids that infest Tea 114
NEW GUINEA: A new Species of *Dermolepida* injuring Cacao 106
PACIFIC IS.: Insecticides against *Dacus dorsalis* in Hawaii 90
PACIFIC IS.: Release of *Lamprophorus tenebrosus* against *Achatina fulica* in Guam 103
PACIFIC IS.: *Cryptophlebia illepida* infesting Macadamia Nuts in Hawaii ... 104
PACIFIC IS.: Introduction of Insects into Fiji against *Lantana* 104
PACIFIC IS.: *Oryctes rhinoceros* and its Control in Fiji and Samoa 105
PACIFIC IS.: Lists of imported Parasites and Predators and recently observed Insect Pests in Guam (*Titles only*) 116
PHILIPPINES: Insecticides against *Prays endocarpa* on *Citrus* 106
PHILIPPINES: Combination Sprays against Cacao Pests 106
PHILIPPINES: Treatments against Insect Pests of Tobacco 107
POLAND: *Empoasca pteridis* infesting Beet 79
RUMANIA: The Insect Pests of Beet 79
SPAIN: The Chemicals used in Plant Protection (*Review*) 77
SWITZERLAND: *Sparganothis pilleriana* attacking Strawberry 77
U.S.S.R.: A Review of the Pests of Beet 79
U.S.S.R.: Observations on *Oscinella frit* and the Status of *O. pusilla* ... 80
U.S.A.: Parasites and a Virus Disease of *Harrisina brillians* 86
U.S.A.: Sulphuryl Fluoride for Fumigation of Buildings against a Termite 89
U.S.A.: Parathion controlling *Quadraspidiotus perniciosus* in early Sprays 89
U.S.A.: Reduced Dosages of Insecticides against *Diabrotica longicornis* on Maize 91
U.S.A.: Seed Treatments controlling Insect Pests on Cotton 91
U.S.A.: Insecticide Treatments against *Trichoplusia ni* 92, 100
U.S.A.: Compatibility of Insecticides and Fungicides for Treatment of Maize Seed 93
U.S.A.: Susceptibility of *Cydia molesta* and its Parasites to Spray Deposits 93
U.S.A.: Malathion for the Control of *Pyrausta nubilalis* 94
U.S.A.: Screening Greenhouses with Insecticide-impregnated Cloth against Thrips 94
U.S.A.: *Platynota stultana* on Cotton and its Control 95
U.S.A.: Oil Emulsion not reducing Yield or Quality of Lemons 95
U.S.A.: Mass Rearing of *Macrosteles fascifrons* 96
U.S.A.: Insecticide Tests against Pests of Shrubs 96
U.S.A.: Control of *Cotinis nitida* and Insecticide Residues 99
U.S.A.: An Outbreak of *Anthonomus grandis* in western Texas 100
U.S.A.: Feeding Sites of *Zeadiatraea grandiosella* on Maize 100
U.S.A.: A Factor lethal to *Heliothis zea* in Maize 101
U.S.A.: Fertilisers and Mite Populations on Apple 101
U.S.A.: Investigations on *Aphis maidis* including the Finding of Males ... 102
U.S.A.: Factors favouring Outbreaks of *Pseudaletia unipuncta* 102
U.S.A.: Two Coccids on Cranberry in Massachusetts 103
A selected Bibliography of the Coccoidea 77
The Effect of Temperature on the Permeability of Arthropod Cuticles ... 82
Relation of Oxygen Consumption to Age and Weight in *Locusta migratoria* 83
Hopper Weight and Number of Ovarioles in *Locusta migratoria* 83
Sulphuryl Fluoride as a Fumigant 88, 89
Effects of Malathion and Isomalathion on Carbohydrate Metabolism 96
The Mode of Dispersal of *Tetranychus telarius* 103
Responses of the Cotton Plant to Schradan and Demeton 108
The Nomenclature of the Groundnut Bruchid 114

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